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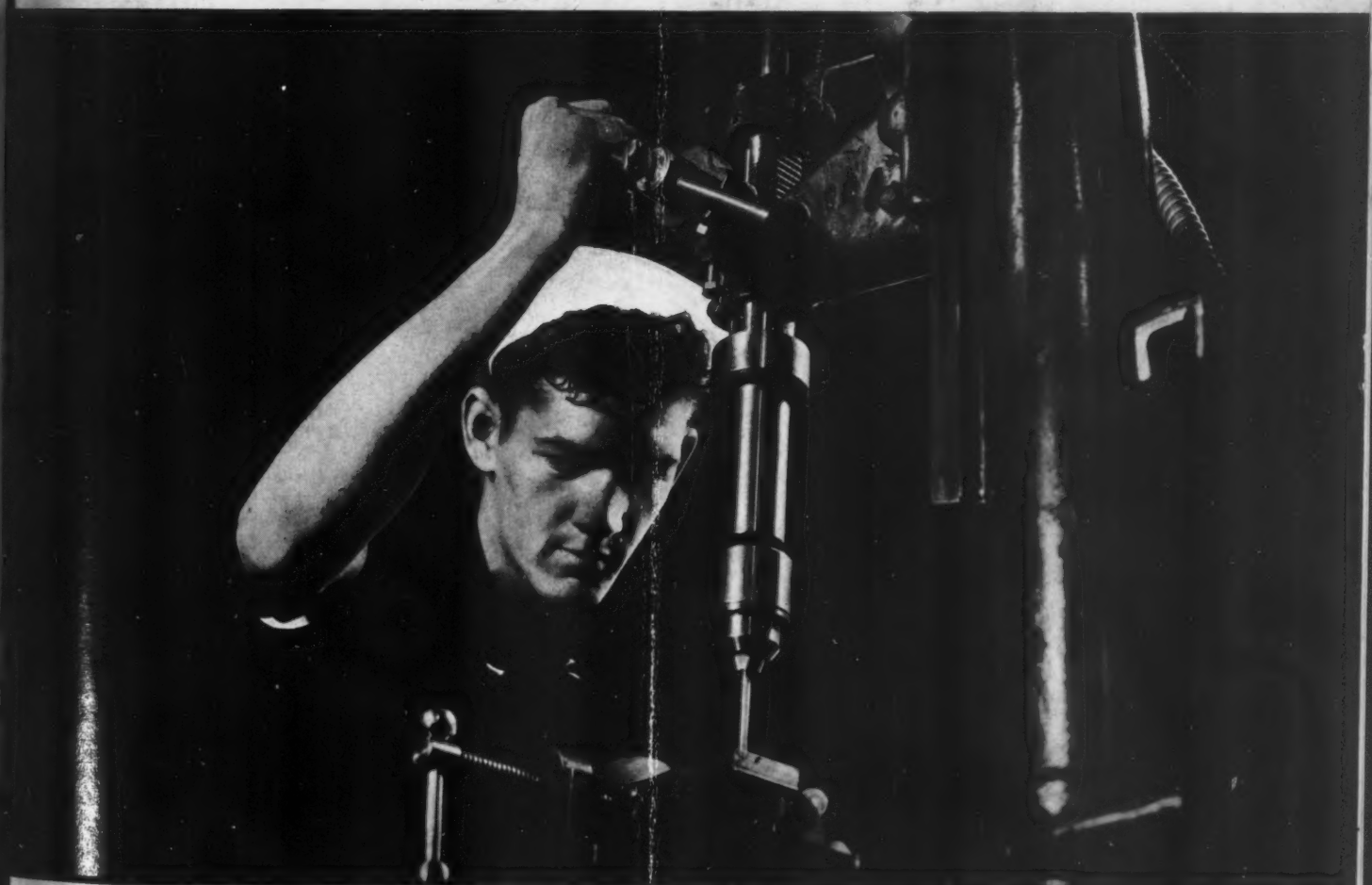

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WARTIME SERVICE EDITION

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INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

VOL. 31 MARCH, 1942 Number 3

THE WARTIME ISSUE OF THE SCHOOL SHOP ANNUAL

Last year's ANNUAL was partly devoted to defense training. At that time many Americans still felt that our entry into the European conflict could be averted. Since then, due to the dastardly deeds of a nation that continued to loudly proclaim its love for this country until the very day of its treacherous attack on Pearl Harbor, defense training has become training for war service.

In this issue, then, this type of training has been strongly emphasized. School systems doing outstanding work in training men who are to prepare America, its army, navy, and air service with equipment and munitions for a victorious war, have contributed descriptions of their methods of handling the job. Others have contributed courses of studies, and shop layouts, all of which, it is hoped, will prove helpful in assisting the schools in doing a better and more efficient job of the task that confronts them.

THIS MONTH'S COVER

The illustration chosen for the cover of the March issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION shows an aviation machinist in training in one of the many schools devoted to this type of work at Detroit.

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Short Talks on Wood

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Utilized to a great extent for paper pulp and also for slack cooperage, matches and excelsior. Its freedom from taste or odor and its light weight and color make it well suited for food containers.

Found very generally in Canada, Alaska, in most of the northern United States, and in the Rocky Mountains south to Mexico. Prefers a moist, sandy soil. Rapid growing. Requires abundant light. Frequently one of the first trees to come in after cutting or fire. Sometimes used as an ornamental.

A graceful, medium-sized tree about 20-60 feet tall and 20 inches in diameter. The branches are slender, extend at right angles to the stem, and form a narrow, round head.

The bark on small trunks or branches is smooth and gray-green to almost white, often marked horizontally. Old trunks are dark gray and deeply furrowed. Leaves are simple, alternate, roundish, about two inches long, finely toothed, dark green and lustrous on the upper surface. They tremble or flutter in the slightest breeze. Fruit is a catkin of small capsules containing fine, tufted seeds.

To date, thirty-three brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

Defense Training

Wartime Service

The Philadelphia Program of Vocational Education for Defense

CHARLES F. BAUDER*

Early Stages of the Program

By approval of the Board of Public Education of Philadelphia, a summer vocational retraining school was opened on July 1, 1940. About 1200 out-of-school unemployed persons were initially enrolled. Nine courses were offered, utilizing the facilities of seven vocational and senior high school buildings. Plans for this project had been made in April and May, 1940, under the stimulus of the Job Mobilization Committee of Pennsylvania, appointed by Governor Arthur H. James. At this time there was still a heavy problem of unemployment in Philadelphia and elsewhere throughout Pennsylvania, although operative and other subordinate jobs were opening up, particularly in metalworking plants, under the influence of the growing demand for national preparedness for defense. The summer school set out to provide instruction and manipulative practice which would increase the employability of its students for operative positions. The financing of the program was arranged to be partly at the expense of the school district of Philadelphia and partly on the account of a Pennsylvania retraining fund administered by the State Department of Public Instruction.

However, nine days after the opening of the summer school, or on July 9, 1940, the Pennsylvania Department of Public Instruction announced the initiation under federal law of a nation-wide program for the training of workers preparing for or employed in industries essential to national defense. The congressional appropriation for distribution through the states enabled immediate transfer of the Philadelphia summer school, in financing, organization, and purpose, to the new Defense Training Program. Enlargement of Philadelphia facilities and the acceptance of additional trainees brought 13 school buildings into service for eight hours a day in an increased variety of activities approved for defense training.

Two types of defense training were recognized by the federal act, namely:

1. *Supplementary instruction* for workers employed in industries essential to the national defense, or in closely allied industries, for their upgrading.

2. *Pre-employment training,* for persons selected from the registers of the public employment service who would look forward to employment in industries essential to the national defense.

By the end of the summer, 1940, about 3700 persons had been served, all of them in pre-employment courses.

Further expansion for pre-employment instruction, and provision for a large volume of supplementary training, came with the reopening of the regular program of the schools in early September, 1940.

The planning for the summer school had been done in consultation with representatives of employing, labor, and relief organizations, and the State Employment Service, in accordance with the school's practice of many years in seeking the counsel of interested agencies for the development of vocational education. Likewise, shortly after the conversion of the summer project to the Defense Training Program, the school authorities invited 60 representatives of employers' groups, organized labor, governmental agencies, and private and collegiate schools to a conference on July 23, 1940, for the consideration of a procedure for continued advice to the schools on needs for defense training and on the types of courses to be offered within the scope of the

School buildings operating all night. The part vocational education plays in the defense program

*Director of Vocational Education, Philadelphia, Pa.

14 essential industries recognized by the United States Office of Education.

As arranged at the July 23 conference, a second meeting was held on August 9, attended by persons nominated by the Industrial Bureau of the Philadelphia Chamber of Commerce, the Central Labor Union of Philadelphia (AFL), the Philadelphia Industrial Union Council (CIO), various governmental agencies, and educational institutions. At this conference it was agreed to form a council advisory to the schools for defense training, and a committee was appointed to plan for the organization of the advisory group.

On August 21, 1940, organization was effected of the Philadelphia Advisory Council on Vocational Education for National Defense, with Dr. Henry Butler Allen, secretary and director of the Franklin Institute, as chairman, and with an executive committee composed of seven persons, and their respective alternates, representative of employing industry, organized labor (AFL and CIO), the public schools, nonpublic educational institutions, and the Pennsylvania Employment Service.

The advisory council has functioned actively and effectively throughout the Defense Training Program. The entire council meets at three-month intervals, and the executive committee sits monthly although during the fall of 1940, the sessions were more frequent. The standing subcommittees of the latter, whose members are drawn from the entire council membership, are: labor demand, labor supply, and effectiveness of school program. Other subcommittees are appointed on special assignments from time to time, for such matters as public relations, additional equipment, trainee selection, and the like.

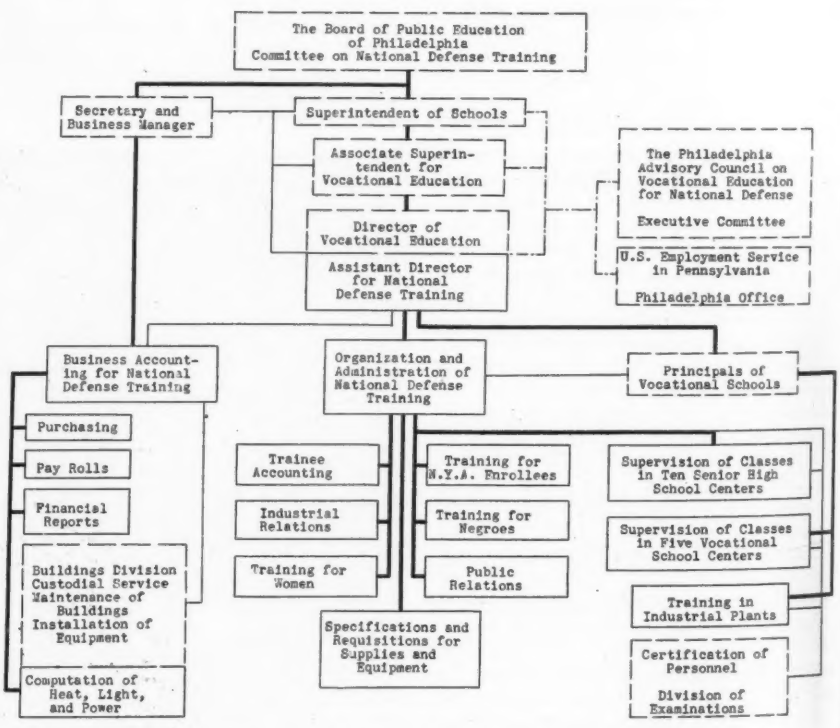
The service of this advisory group has been of inestimable value to the public schools. The Defense Training Program has been kept realistic in purpose and organization, employers have been made aware of the training service and of the value of the trainees, difficulties as between the points of view of management and labor have been avoided, and defense production itself in this large ordnance producing area has been facilitated. The schools, too, have grown in the respect and confidence of industry, and the regular program of vocational education has gained increased recognition as an approved agency for preparing new workers and for upgrading the workers already employed.

Present Extent of the Program

In the eighteen months since July 1, 1940, the Philadelphia National Defense Training Organization has served an enrollment of 73,666 persons in 65 courses. Of this number 34,076, or 46 per cent, have been employed persons seeking upgrading instruction, and 39,590, or 54 per cent, have been unemployed or working in nondefense activities. Over 30 of these courses have been new to the schools since July 1, 1940. A mere listing of the subjects gives an interesting insight into the diversity of the calls for defense instruction in this city.

Airplane Mechanics (NYA)
Anglesmithing (ship)
Army Cadet Corps (pretraining)
Army Cooking
Assembly and Repair (Signal Corps)
Auto Body Reconditioning
Auto Mechanics — Motor
Auto Repair (Signal Corps)
Basic Army Photography
Blacksmithing (ship)
Blueprint Reading (metalworkers)
Cabinetmaking (Signal Corps)
Clothing Inspection (Q.M.Depot)
Coppersmithing (ship)
Drafting (junior)
Electrical Construction
Electrical Maintenance
Electric Motor Repair (Signal Corps)
Electrical Repair (Signal Corps)
Foremanship Training
Foundry Practice
Glass Blowing (instrument)
Industrial Instrument Maintenance
Instrument Inspection
Instrument Making (Signal Corps)
Lens Grinding (Frankford Arsenal)
Light Manufacturing Operations
Machine Erecting and Assembling
Machine-Tool Operation
Machine Operation (Signal Corps)
Marine Pipe Fitting
Naval Stenography (Navy Yard)
Operative Hand Embroidery (Q.M.Depot)
Ordnance Inspection
Packing and Container Repair (Signal Corps)
Patternmaking
Pipe Fitting (Signal Corps)
Power Sewing-Machine Operation
Precision Lathe Operation
Radio Communication and Repair
Radio Repair (Signal Corps)
Related Drawing
Related Instruction — Electrical Trades
Related Instruction — Metal Trades
Related Mathematics
Related Subjects — Auto Mechanics
Related Subjects — Foundry Practice
Related Subjects — Shipbuilding
Sheet-Metal Work
Sheet Metal — Aircraft
Sheet Metal Layout
Ship Fitting
Ship Mold Loft Work
Shipping and Receiving (Signal Corps)
Ship Rigging
Ship Wright Work
Shipyard Storeroom Practice
Steam Fitting
Switchboard Assembly
Telephone Repair (Signal Corps)
Tracing
Welding — Acetylene
Welding — Electric
Welding — Gas (airplane metals)
NYA Educational Program

The present program employs 640 teachers and 25 administrators, co-ordinators, and business supervisors, together with 75 secretaries, 107 stock clerks, and 2 messengers, exclusive of the regular administrative and co-ordinating staff of the central office and the schools. Fifteen schools and two NYA centers are utilized 24 hours a day, with one school now operating seven days a week. Classes are also conducted in three government establishments and six private plants. The closing net enrollment as of December 31, 1941, was 10,935, of whom 4404 were pre-employment


The Board of Public Education of Philadelphia Committee on National Defense Training
Secretary and Business Manager
Superintendent of Schools
Associate Superintendent for Vocational Education
Director of Vocational Education
Assistant Director for National Defense Training
The Philadelphia Advisory Council on Vocational Education for National Defense
Executive Committee
U.S. Employment Service in Pennsylvania
Philadelphia Office
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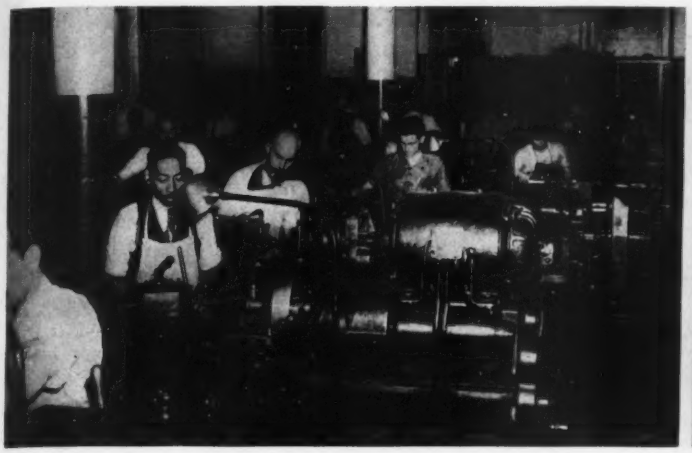
Purchasing
Pay Rolls
Financial Reports
Buildings Division
Custodial Service
Maintenance of Buildings
Installation of Equipment
Computation of Heat, Light, and Power
Organization and Administration of National Defense Training
Trainee Accounting
Industrial Relations
Training for Women
Training for N.Y.A. Enrollees
Training for Negroes
Public Relations
Specifications and Requisitions for Supplies and Equipment
Principals of Vocational Schools
Supervision of Classes in Ten Senior High School Centers
Supervision of Classes in Five Vocational School Centers
Training in Industrial Plants
Certification of Personnel
Division of Examinations
Solid Line Blocks Indicate Functions of Persons on National Defense Pay Roll
Dotted Line Blocks Indicate Persons or Agencies Not on National Defense Training Pay Roll
Dot and Dash Lines Indicate Advisory Relationships with Agencies Not in Public School System
Heavy Solid Lines Indicate Direct Line of Responsibility
Light Solid Lines Indicate Consultative and Co-operative Relationships Within the Public School System



A pre-employment class in machine-shop operations. Franklin High School, Philadelphia

A pre-employment class in tubular welding. The Edward Bok Vocational School, Philadelphia

trainees, 6062 were in supplementary courses, and 469 were NYA enrollees on nondefense work-experience projects. Allocations of federal funds for purchase of equipment during the past year have amounted to about $650,000, on which about 80 per cent of the items have been received and placed in operation and the remainder is expected to be in service by February 15, 1942. The equipment now being awaited will enable increase of pre-employment enrollment by about 600 persons through the 24 hours of a day or about 3600 a year.

Stages of Functioning of the Defense Training Program

Three distinct stages have been observed in the functioning of pre-employment training for defense industries:

Cutting steel ship plate with acetylene torch. Jules E. Mastbaum Vocational School Annex, Philadelphia

1. *Stage of Unemployment.* From July 1, 1940, to about April, 1941, Philadelphia industries were essentially in the stage of analyzing the very large contracts awarded by government agencies, and of retooling and expanding their plants to permit of rapid and large production. By the advice of the Advisory Council for Defense Training and the State Employment Service, the public schools created a large pool of narrowly trained persons through the pre-employment courses, against the time when these workers would be called for in great numbers. For the most part these pre-employment persons were unemployed, except for NYA, WPA, or Department of Public Assistance enrollment. Jobs opened up steadily for our trainees during this period, both in defense activities and in nondefense work, although it was impossible for the schools to have complete knowledge of the success of all the trainees in securing employment. Traditional practices were still observed by personnel departments; racial and nationality considerations remained in the picture. Civil service requirements continued on established lines, and the public employment service had not yet secured the full cooperation of many employers.

2. *Stage of Reviving Employment.* About April, 1941, industries were coming into full production. Cramp's Shipyard, recently reopened, had developed to the point of substantial progress on federal contracts; other shipbuilding companies along the Delaware River were increasingly active; the Philadelphia Navy Yard, the Frankford Arsenal, and the Army Quartermaster's Depot were expanding their working forces; Baldwin Locomotive Works, S.K.F. Industries, Inc., Bendix Corp., Empire Ordnance Co., Midvale Steel Co., and many other large plants were ready for large production; the civil service requirements for trainee and helper positions were revised; and the public employment service, with recently added facilities, was meeting an accelerated demand for workers of the semi-skilled and operative type. Employers increasingly visited the public schools in their search for routine mechanics. The pool of labor created by the schools in the earlier period began to disappear. WPA, NYA, and the relief agencies showed a marked reduction in their rolls as the school-trained workers received private employment. Trainees for pre-employment courses decreased in availability for eight-hour shifts of schooling, although there was a large waiting list for evening retraining on the part of men employed in nondefense activities.

3. *Stage of Conversion from Nondefense Work to Defense Work Activities.* It has been maintained consistently by our industrial advisers that the Philadelphia commuting area contains enough persons, granted proper training for them, to care for a very large expansion of defense industries in this region, except for the minority of jobs in which peculiar or long-continued training and experience would be required for key positions. This third stage, as we have observed it, is essentially one of rapid conversion of workers from nondefense types of work to defense industries. The present trend in the search for new workers in defense plants began in the early fall of 1941 with one of the large manufacturing plants adopting the policy of recruiting workers of proper aptitude on a learner's wage scale, with immediate reference of these employed learners to the public school Defense Training classes. After six, eight, or ten weeks of intensive training, the learners have been recalled to production work in the plant on an advanced wage. This practice was soon followed by the Philadelphia Navy Yard, the Frankford Arsenal, and the United States Signal Department located in this city, utilizing the United States Civil Service for the recruiting of learners on a "mechanic-learner" wage, and the facilities of the public schools for the initial training of the learners. This arrangement brings school and industry very closely together.

This period has also brought increased collaboration between private plants and the public employment service, in agreements by which, *commitments* for given numbers of workers would be made by the respective employers with the employment service and immediately referred to the public schools for training to the stated specifications.

Training sheet-metal workers for ship building. Jules E. Mastbaum Vocational School Annex, Philadelphia

Supplementary instruction in marine pipe fitting. Also the Edward Bok Vocational School, Philadelphia

Enlargement of the Schools' Facilities

At the particular request of the newly opened Cramp's Shipyard in Philadelphia for pre-employment training of welders, shipfitters, loftsmen, and other shipbuilding mechanics, the board of public education authorized in March, 1941, the leasing of a five-story and basement factory building close to the Mastbaum Vocational School and convenient of access to the Cramp plant. From the first federal allocation of equipment funds to the Philadelphia schools was financed the special equipment required for this expansion, enabling by May, 1941, a large volume of training service in a wide range of shipbuilding activities. The board of education provided the rental for this building until July 1, 1941, after which the Federal Office of Education, under new congressional authorizations, has reimbursed the board for this charge.

Increasingly since the start of the training program the schools have met growing demands by opening the shops and classrooms for more and more hours per week, so that at the present time every high school and vocational school which has proper shop facilities is operating around the clock. The rented building which has been mentioned is operating seven days a week, 24 hours a day, entirely in defense training, and the other buildings are scheduled soon to remain in service on this continuous basis.

To be sure, the schools have preserved thus far the regular program of vocational education by which young people of high school age are trained in three-year courses to enter industry as advanced apprentices, and thus to provide a continuous flow of all-round skilled mechanics and prospective leaders and foremen. A given high school or vocational school is thus occupied from 8 or 8:30 a.m. to 3 or 4 p.m., in regular vocational education; pre-employment classes use the facilities from 3 to 7 or 3 to 11 p.m., and from 11 p.m. to 8 a.m.; supplementary students are served in evenings and on Saturdays. More rented buildings and more equipment are being planned, as additional federal funds become available.

Organization of the Defense Training Program

The chart of functions and relationships which is included in this article indicates the complete support which is given to the program by the board of education and the instructional and business departments of the board. It illustrates, too, the co-ordinate relationship which exists under Pennsylvania school law between the superintendent of schools, for instruction, and the secretary and business manager, for business accounting. Practically all of the administrative and supervisory officers have been drawn from the experienced regular staff of the school organization. A teacher or department head or business executive has been invited to serve full-time on the national defense training staff on leave of absence from his regular position. All of his rights as a permanent member of the school's organization are preserved. For most of the defense training positions the period of service of such a detached person is a year of 11 months, after which he reverts to his regular position and is replaced by another school person. Lengthy interference with the normal school program is thus avoided, and numbers of excellent teachers can be given a run of administrative work which ordinarily they would seldom experience. Of course, in addition to the officers whose functions are shown on the chart, a considerable number of secretaries are required to carry on the extensive paper work required by the federal and state regulations.

Nearly all of the defense training teachers have been drawn from industry. The only exceptions are certain regular teachers who conduct supplementary instruction at hours other than those of their normal school schedules. Teacher improvement is carried on informally by the co-ordinators assigned to the several training centers.

Month-by-Month Statement of Development

The following section is abstracted from the periodical reports made by the division of vocational education to the advisory council. They indicate the resourcefulness of the school system and its ability to secure and adapt facilities to meet the rapidly increasing demands for training which have come from defense industries in Philadelphia.

August, 1940. About 700 Work Projects Administration enrollees admitted as initial group of WPA defense trainees.

September, 1940. Rescheduling of the Defense Training Program, for avoidance of conflict with the regular day and evening schools, with increased provision for service to trainees, including 3 buildings operated from 10 p.m. to 6:30 a.m.

Opening of Bartram High School Saturday morning classes to serve apprentices of industrial plants in southwest Philadelphia.

October, 1940. Announcement made of federal money available for purchase or rental of equipment for use in public schools in defense training.

December, 1940 — January, 1941. Beginning of inspection of defense schools by a committee of the advisory council. Requests forwarded, according to the form supplied by the United States Office of Education, for equipment necessary for enlargement of the Defense Training Program, including that required for new types of courses in connection with ship trades and aircraft construction training, totaling close to $400,000.

NOTE: In due time all of these requests were approved by the state and federal authorities.

Announcement of federal appropriation available for a program of instruction for young persons employed on NYA work projects.

February, 1941. Beginning of instruction of NYA enrollees with rapid expansion planned. Three types of training recognized:

a) Courses supplementary to the work experience provided by NYA.

b) Courses for preparatory training for improvement of the occupational adjustment of NYA enrollees.

Power sewing-machine operation at the NYA work experience center

Precision lathe operation for the aircraft instrument industry. The Edward Bok Vocational School, Philadelphia

c) Instruction designed to enlarge the civic or vocational intelligence of NYA enrollees.

State and federal approval requested for tryout courses for improvement of the selection of pre-employment trainees.

Approval by Philadelphia board of education of rental of the Orinoka Building, Ruth and Somerset streets, for marine trades training on defense account.

Additional high school buildings opened for all-night classes.

Bartram High School Saturday program for supplementary instruction enlarged to include afternoon classes.

March, April, 1941. Orinoka Annex of Mastbaum Vocational School opened for mold loft work, electric welding, marine sheet metal. Classes in other activities awaiting receipt of equipment.

After close of regular evening school program on March 26, seven high school buildings reopened for evening instruction on March 31 for national defense training, and four vocational schools continued on 24 hours a day schedule. Six high schools now have all-night classes.

Philadelphia office of state employment service assigns a full-time person to the schools to work on a plan for a co-ordinated service of placement for pre-employment trainees.

Approval secured for tryout courses in six junior high school buildings, for selection of pre-employment trainees.

June, July, August, 1941. Beginning of definite requests from large industries for pre-employment training to particular qualifications.

State employment service increases its facilities for interviewing and referring for training pre-employment applicants.

Local council of administrators organized under federal regulations, consisting of a representative each of the public schools, the state employment service, and the NYA, for consideration and approval of training commitments from employers and of needed courses of instruction.

Philadelphia office of United States Civil Service Commission increases its requests for specific training in activities of government industries.

NYA enrollees increasingly assigned to defense types of work experience. Defense Training Administration of the public schools arranges with NYA to assume responsibility for full time (160 hours per month) for NYA enrollees assigned to defense work projects. Instruction and work experiences to be indistinguishable.

Increased service arranged for Philadelphia Navy Yard apprentice program.

September, 1941. Work Projects Administration announces its authorization to set up a placement agency for its enrollees who had been trained in public school defense classes.

Readjustment made of defense training schedules because of reopening of regular day and evening schools. Every vocational and senior high school building, and three NYA centers, now operating 24 hours a day.

Increase in enrollment of indentured apprentices as supplementary trainees, under stimulus of the federal committee on apprenticeship.

Defense Training Centers

The following list contains the names of those schools in which Defense Training is carried on as of September, 1941.

Senior High Schools: Bartram, Frankford. Franklin, Germantown, Gratz, Northeast, Ilney, Overbrook, South Philadelphia, West Philadelphia.

Vocational Schools: Bok, Dobbins, Fleisher, Mastbaum, Mastbaum Annex.

NYA Centers: Broad and Poplar Sts., 28th St. and Passyunk Ave., Broad St. and Lehigh Ave., 41st St. and Mantua Ave.

Government establishments: Frankford Arsenal, Philadelphia Navy Yard.

Manufacturing plants: Brown Instrument Co., Wm. Sellers and Co., Inc.; Philco Radio and Television Corp.; Kellett Autogyro Corp.; I.T.E. Circuit Breaker Co., Cramp Shipbuilding Co.

The cumulative enrollment in defense courses from July 1, 1940, to September 30, 1941, amounted to approximately 58,000, of which about 28,000 were supplementary students and about 30,000 were pre-employment trainees.

It is estimated that as of September 30, 1941, approximately 16,300 pre-employment persons had secured gainful employment. Their wage for one month amounts to more than 150 per cent of the total cost of the Defense Training Program for the 15 months of operation.

October, November, 1941. Arrangements made by Westinghouse Electric and Mfg. Co. and the Philadelphia Navy Yard to place on their pay rolls mechanic-learners who meet aptitude tests set up by the firm and the civil service commission, respectively, and immediately to assign the learners to the public schools for intensive training for 40 to 44 hours a week, under training specifications provided by the employers. The Frankford Arsenal and certain private plants are also interested in this plan.

NOTE: As of November 15, 1941, 205 Navy Yard learners are enrolled in six school buildings, in four trades, mostly in all-night classes, and 265 learners assigned by the Westinghouse Co. are in eight school buildings, eight hours per day between 3:30 p.m. and 8 a.m., in machine-shop operations. Some 20 other Westinghouse learners, having completed their training, have been placed in production work in the Lester plant. The Franklin High School machine shops are preparing men for the Frankford Arsenal, although not yet on the Arsenal pay roll.

Four area placement interviewers assigned by the Philadelphia office of the Pennsylvania employment service to the vocational schools to expedite the interviewing and admission of pre-employment trainees and their placement after training should be included.

The course in basic photography in the Bok Vocational School, originally organized for National Youth Administration enrollees, which was discontinued for a time due to the lack of NYA students, reopened for 20 marines assigned from various parts of the country for this training.

December, 1941. An exhibit of defense training activities placed in the Franklin Institute by the public schools, at the invitation of Dr. Henry Butler Allen. Exhibit opened at the beginning of Philadelphia Defense Week, December 1 to 6.

By invitation of the Philadelphia Defense Council, the public schools participated in the defense parade of December 6, with some 750 defense trainees and their instructors, five floats, and three bands.

The incidence of war conditions brings a pressure upon manufacturing plants for the speed-up of defense production, and increased calls upon the public schools for training service. Representations are being made to federal defense training authorities for a grant to Philadelphia to enable the purchase of additional machine-shop equipment.

NOTE: An allotment of $160,000 was granted and immediately placed under contract.

It is significant that during the past three months the average time spent by a pre-employment trainee in school has greatly decreased compared with previous periods, indicating (1) the increased demand for partially trained men and (2) the acceptability of the school-trained persons for beginning jobs.

Vocational Education in Detroit Mobilized for National Defense

EARL L. BEDELL[1] WALTER E. GLEASON[2]
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Administrative Organization to Carry Out the Federal-State Plan

The challenge to the Detroit vocational-education program to train workers for defense production industries was tackled with the creativeness and energy characteristic of the Detroit public school system. July 1, 1940, is a memorable date in Detroit vocational history, for, on that day, the board of education responded to this new challenge by authorizing the superintendent of schools to set up the proper administrative machinery for adapting the vocational program to the production needs of defense industry. From this action there emerged the vocational-education program for national defense, and immediately a small staff was assigned the responsibility of organizing and installing an appropriate instructional program. When this staff approached its task, two important elements in the problem of creating an effective organization were quickly recognized; namely, the setting up of basic standards with respect to regulating the selection and training of workers, and the co-ordination of the different industrial interests and community agencies toward the realization of a common goal. Of course, this problem was not peculiar to the city of Detroit. In undertaking a defense training program, every school system throughout the land was sailing on somewhat unchartered seas. However, rules and regulations were soon forthcoming from the United States Office of Education, operating through the various boards of vocational education in the several states.

The first problem involved the creation of a system of trainee referrals from the Works Progress Administration and a basis for co-ordinating all community agencies concerned had to be determined. Because mass production depends upon division of labor, the demand by employers and employee groups for an instructional program that would furnish supplementary training was a natural consequence. The Michigan employment service and the board of education, in a spirit of mutual cooperation, worked out an orderly procedure for co-ordinating their activities toward the attainment of a sound training program.

At the very outset of the vocational-education program, it became evident that careful planning and execution of the program would require some arrangement for keeping the responsibility for its direction in close touch with industry. Like a military force that cannot operate at any great distance from some fixed base, so any vocational program of conversion or supplementary training must establish constant contact between it and the industry and the various industrial groups involved. In order that the school administration could make decisions, begin actions wisely, and exert them in relation to the community needs within each industrial unit some organized setup had to be evolved. In consequence, an advisory committee to the superintendent was established and it was composed of balanced representation from the two main labor groups in Detroit, and representatives from the employers, and a citizen at large. The representatives selected for membership on this committee were top-flight individuals in their respective organizations and in the community, and after nearly two years of service, this committee is still functioning effectively with its original personnel.

Confronted with a tremendous responsibility, this advisory committee realized that all its actions must be mounted in hard facts rather than personal opinions and prejudices. A resultant activity of this conclusion was the establishment of an industrial-needs committee whose function was primarily to interpret facts which industrial surveys might reveal. Thus, this committee served a dual purpose: (1) to make detailed surveys of the personnel needs in the different industries in anticipation of an enormously speeded-up production, and (2) to analyze the facts collected and, on the basis of them to make constructive recommendations to the advisory committee. In order to determine what the occupational training needs were, this committee turned for assistance to the Detroit employers' association, the Michigan employment service, and other standard sources of information such as: the investigations of organized labor and the reports of the Federal Census. All agencies involved were generous in supplying trained technical assistance in accomplishing this purpose. To be effective

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Schools that function 24 hours per day

Related instruction

any training program must anticipate needs, else it will be too late because all training requires time and effort.

The Teaching Personnel and Its Recruitment

The foundation stone to any educational structure is the teaching personnel and especially was this the case with the vocational-education program for national defense in Detroit. In the beginning, both the classroom positions and the supervisory and administrative staffs were made up entirely of teachers who met the standards in the respective fields of professional work. In Detroit a professionally trained teacher means, among other things, an individual who has completed a four-year college curriculum and has secured the Michigan State Teachers Certificate. Because the defense program was launched during the summer vacation, the problem of securing a sufficient number of qualified vocational teachers was difficult. However, by sending out urgent telegrams, it was possible during the months of July and August to organize the staff for the instructional program, but, in anticipation of the opening of the regular school year in September, an appeal was made to industrial employers and labor-union offices for additional men to staff the classrooms. Fortunately, applications from men for these positions began to pour in, in large volume. These applications were stimulated not only by management of the respective industries, but also by the officials of the different unions. Arrangements have now been made so that the stimulation is cooperative and is usually accomplished by posting notices announcing the teaching positions on plant bulletin boards.

There were many misgivings when it came to inducting into the program a large number of teachers who had very little or no professional education. However, compensating for the lack of professional training in education was their high degree of consecration to the job to be done. In general, these men were open-minded and had a strong desire to learn. Fortunately, it was possible to distribute among the new recruits the professional teachers who were generous in their time and efforts in assisting these men. Moreover, after nearly two years of continuous intercontact, both the professional teacher and the new recruits have been mutually benefited.

Continuous improvements in the quality of the instruction is an ever present goal and such devices as teachers' meetings and group conferences, familiar to all vocational people, have been used to accomplish this end. It is necessary, however, to admit that because of certain conditions inherent in the very nature of the program, the teacher training is very inadequate. It is the hope of the school administration, in the months to come when the program has reached a steady level, that teacher training will be given its proper time and place in the vocational program.

The Single Skill Job — The Unit of Instruction

Part of the task of training workers involved drastic modifications in the mental approach to the organization of instruction. Just as industry found it necessary *to dilute* certain factory occupations in order to satisfy defense labor needs, so it became imperative to concentrate on training for a single-skill or pay-roll job. No longer were vocational educators to emphasize the development of broad job background and social attitudes. Thenceforth, in the defense training program, skill in performing a single production operation based on manipulative performance was to receive the entire focus of classroom instruction. Now this eruption, out of the national emergency, of only *one* of the objectives of vocational education was a hurdle which the vocational program had to vault at the very outset. The concept of training for a single-skill job was difficult to develop in the mind of the professional teacher who had been so thoroughly schooled in teaching an entire subject. The time element, which is the essence of the present emergency, made it obviously impracticable to train a man in anything but the skill he would use when he arrived on the job. Another element that entered into the training in the single skills was the fact that almost overnight the Detroit automobile industry was being suspended and a group of entirely new industries was being developed, such as manufacturing aircraft materials, tanks, and guns. In some instances it was necessary to find instructors to train teachers in some of the new skills preceding the opening of classes for the trainees, as for instance, in aircraft riveting and metal forming.

Correlating the Job Analysis With Instructional Analysis

The organization of an instructional program based on job-training required that a continuous program of job analysis be established and maintained. By job analysis is meant the study of the requirements of a pay-roll job, and obviously the only place and the only conditions under which such a study and analysis can be made is on the job. It was not enough to know that a given industry needed lathe operators; it was essential to know exactly what operations constituted lathe work and then to gear the training into those specific operations. The same problem existed with respect to running a milling machine, the shaper, the planer, the grinder, and the drill press. Inspection was another important job that required job analysis. Men had to be trained in the use of certain specific gauges and measuring devices because the exact job requirements were unerringly known. Following the completion of the job analysis came the task of devising ways and means of teaching any given operation or series of operations; in other words, instructional analyses were required. The first step toward correlating these two major elements in the training program was the setting up of preliminary exercises which matched manipulative skills and controls identified on the industrial production line. Devising of suitable techniques of instruction became the next step with the added task of discovering methods of transmitting to other teachers these *tricks of the trade* in order that uniform teaching efficiency could be attained.

The job sheet has been found to be the

Parts-inspection training

Riveting airplane parts

Metal forming

Welding

best method evolved to facilitate interchange of ideas among the teaching personnel and at the same time the best way for a supervisor to transmit effective teaching technique. The new industries which we are required to staff with trained workers has made it necessary for us to produce job sheets in very large numbers.

The Job Instruction Sheets as the Basis of Standardized Training

The job instruction sheet has been accepted as the unit of standardized training in the vocational-education program for national defense. Extensive as has been the standardization of the production of consumer goods today, much greater is it the case in defense production industries. Since training of defense personnel must correlate with the job requirements as revealed in the surveys made by the industrial-needs committee the instruction furnished by the vocational-education program for national defense must of necessity be highly standardized. Hence, the wide use of the job sheet as the unit of standardized training is a natural consequence. This method follows a uniform and fixed pattern of instruction and provides an orderly procedure in the learning process. Each job sheet consists of the following elements listed in order of occurrence: name of the project, reason for the job, safety caution, materials to be used, tools to be used, procedure in executing the job, reading references, and questions for study. A detailed drawing of the project is included. Under *Procedure* the duties and operations of the job are presented serially, and the directions supplied are precise, direct, and specific. The listing of tools and materials secures economy and efficiency in job production and training while priority of *safety* over *materials, tools,* and *procedure* fortifies the safety program in modern industry as well as in school shops.

Placed in the hands of individual students, the job sheet has proved to be an effective device for teaching how to do a job according to industrial production specifications. Of course, this instructional technique requires supplementation by the classroom instructor. In no sense is the job sheet considered as a teaching device which can function independently of teaching personnel. To be effectively used the job sheet must be followed up by lecture-demonstration by the instructor.

The major value of this method of job training is its ready adaptability to any specific industrial-production job and its training requirement. Job-sheet teaching makes possible short unit courses and uniform instruction, thus aiding mass training of defense-industry personnel. From the viewpoint of industry, job-sheet-trained workers enabled industrial engineers and technicians to control a product at all stages of its manufacture, from the master design to the smallest manipulative operation. Measured in terms of material and labor costs this technique of factory personnel training is of incalculable value.

THINGS TO THINK ABOUT

By the late R. W. SELVIDGE

Skill is a thoroughly established habit of doing a thing in the most economical way.

Technique is the procedure for doing a thing skillfully.

We may instruct an individual in the technique of a process but he must acquire the skill through practicing the technique.

Speed and accuracy are essential elements of skill. Speed is a habit; accuracy is an ideal. Speed is acquired through practice; accuracy means conforming to a standard. Speed is the road to efficiency and accuracy.

A definite idea of what is required is the first step in developing skill. This consists of the standard of accuracy. The next step is to learn the procedure involved in attaining the accuracy economically. This is the technique. The third step is to proceed with as much speed as possible while practicing the technique and striving for accuracy. This is economy and prevents the development of slothful habits.

The acquisition of skill involves the acceptance of an ideal and a striving through practice and drill to conform to that ideal. Skills are established in no other way.

Civilian Defense and the Schools

ROBERT W. TARBELL*

From time immemorial the men did the fighting. The call of the chieftain roused the ablest in the tribe, who donned their fighting regalia and went forth to battle. The midnight ride of Paul Revere brought out the minutemen. His feat has been duplicated countless times. Down through the history of warfare the nations, with a grim code of ethics about the virtues of battle, have left their women and children and the aged at home. Struggle was reserved for the young and strong. The wounded were safe in hospitals. Homes were not molested. The fighters were enrolled in the army or navy. The rules of the game respected the rights of noncombatants. It was not deemed necessary to set up special precautions for the safety of innocents.

Totalitarian Warfare

The enemy has declared a totalitarian war. The rights of humanity are tossed into the discard. Respect for innocent people, helpless women and children, peaceful homes, the sick in hospitals has disappeared. All these are ground ruthlessly under the iron heel of the conqueror. The aggressor summoned the total resources at his command. Attacks are not limited to the usual fighting units. Neither are the objectives confined to the traditional military goals. We expect armies to be captured, soldiers to be killed and wounded, equipment taken, forts demolished. We can become callous to the loss of ships and planes. Captured territory is accepted along with the fortunes of war. But our conception of human decency rebels at the sight of a blitzkrieg against the helpless members in society. The avowed intentions of the attackers, according to their own proclamations, is to annihilate all opposition and reduce other peoples to a state of abject slavery. In this struggle the enemy respects no rights or traditions. International law, as it applies to warfare, means nothing. The old principle of respect for an "open" city has been wiped out. Traitorous attacks have been made, even while manifestations of peace were occupying the limelight. This is a new type of finish fight, and the United States has been catapulted into it.

Civilian Defense Measures

The problem of civilian defense is at our doors. If peaceful cities are to be bombed, we will discover the means to combat the attack. If homes, hospitals, churches, and schools are to be targets for destruction, the resources of a free people will be marshaled to meet the challenge. This means an immediate plan of protection.

Civilian defense will differ according to the location and size of the community. Obviously the danger of bomb attacks will be greater in the large cities and accentuated in the coastal regions. And we have not been idle in our plans. President Roosevelt some time ago set up an office of civilian defense to work on a national scale. The country as a whole began to learn some of the new terminology. The technique, as well as the inconvenience, of blackouts became part of our daily lives. Air-raid warnings are coming closer. The organization of committees to administer the plan is going forward on a city-wide and state-wide basis, and co-ordinated with the national setup. Men and women are being trained for specific duties. Equipment is being procured. Whole communities are being instructed in the details of activities that must be understood if a concerted plan of defense is to be in operation. Some can give first aid, others can put out fires. Minutemen in every block can be on the alert to sound the alarm and go into action. It is not the thought here to instill fear or to unduly alarm anybody. But the country is at war. We must be ready for unusual events.

The public schools are not forgotten in this program of civilian defense. A school building is a sizable target and could easily be hit. School teachers have an important, immediate problem on hand to set up a plan of defense for school and students. How the plan will function depends on local conditions. The moves to be made and the organization to be perfected will be determined in part by a variety of factors to be discussed in this article.

Types of Dangers

In the first place, we fervently hope that no bombs will fall on a school. But if such a disaster should occur, there may be falling walls, destruction of equipment, and loss of life. More likely than that there may be incendiary blazes. Schools are open buildings. People come and go. We have not been in the habit of requiring a passport when people enter the doors. We cannot close our eyes to the danger of sabotage. There are undoubtedly people in every community who would easily give in to subversive tendencies. And sabotage can appear in numerous ways. Whether it is by fire, destruction of property, theft, or any form of attack, dangers are about us. Riots can be incited. People are more emotional under the strain of war. Some will give way to hysteria, with all the problems that follow in such cases. And the fifth columnist may appear unexpectedly. Even in this land of splendid opportunity there are adverse currents of human thought, and some people are bent on nefarious work. They are a menace. They must be apprehended and dealt with in a summary manner.

These dangers will vary in different places, as indicated already. Large school buildings will have special problems of student routing in case of an evacuation. Blackouts will vary with the locality. Dangers from fire will depend on congestion, age of the schoolhouse, equipment, and the like. The administrator and his staff in a large organization will be faced with possibilities that do not appear in a small community. The middle sections of the country will not be concerned in the same way as those along the seaboard.

The Schools Go Defense

The schoolmaster has gone in for civilian defense. We thought it couldn't happen here. But the days of isolation are over. It is time to turn grimly to the business at hand. Defense of the school will fall largely on the shoulders of school people. Every faculty should begin at once to set the house in order. A cursory program will not do. The school system is not planning a picnic nor a senior debate. Dire happenings are possible. Life and property are at stake. Survey the situation with precision, set up a definite program and rehearse with diligence!

There are some common factors in every school in the country. We can begin with these to set up a plan for all communities. Special cases will submit to solution quite readily.

The first step is to understand the dangers that may be encountered. Literature or plans can be obtained from civilian-defense committees in the city and state. Possible avenues of attack have already been mentioned in this article. After the danger spots have been surveyed steps can be taken to guard against attack.

The second step is to organize the entire institution. It is well to keep in mind that the scope of activity is confined to the school. If students and staff wish to act as minutemen in their neighborhood, that is very fine, but such service will not usually come under the auspices of the school. Someone in the school building, probably the principal, will take the lead in setting up plans. In making preparations for civilian defense it is well to be prepared for the worst. If the worst that can happen is a one-ton bomb dropped on the schoolhouse from a height of one mile, be prepared for it. If the building burns to the ground or is partially wrecked by a planted bomb in the corridor, be ready for immediate action. We are at war, and the enemy is grim, resourceful, and alert. In the face of these possible events a survey of student and staff personnel is imperative. How would the student body be handled in case of catastrophe? Are there cripples, epileptics, or hysterical students in the building? What about the staff in this respect? All these people should be surveyed with an idea of the proper moves in case of disaster. Some students will be especially useful as captains of groups. Leadership is a prime essential in handling aggregations of people during the stress of an unusual event. In the same way some staff members are equipped by nature

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and training to do certain jobs better than others.

Another matter of major importance is a thorough study of the school plant. Are there inflammable materials in storage? Are the exits understood by all so that a blocking of one will not cause a panic? In case of fire in the building are there facilities at hand and people trained to use them efficiently before a blaze can get under way? An attack of any kind might necessitate temporary herding of students and staff in the school. There might even be problems of feeding if the scare lasts for an extended time. There will be problems of water, heat, sanitation, etc., as well as special difficulties in each situation. What parts of a building are safest during an attack and where are the hazards? If the student body marches to the basement, can everybody get out readily in case of a fire? A group of students, and the faculty also, may get panicky if the building fills with smoke and if there is commotion in the neighborhood. Every person in the building should be trained to take a given exit in case of danger. Stairway routing is important, even in small buildings.

Now, let us assume that the surveys have been made, posters and directions have been set up, and the organization is complete. Facilities are in place. Another step is necessary, a continuing phase, that of rehearsals. If your building has had a perfunctory fire drill now and then, don't lull yourself into the belief that the school is ready. It might be a grevious error. Complete evacuation of the building, by prescribed routes and on a time schedule, should be on the agenda of activities. And these movements should approach military precision. Since an ounce of prevention is worth a pound of cure, a well-guarded building may prove to be the best means of defense. If anyone has intentions to start a fire in the building or to perpetrate some other deed of depredation, his actions will be discovered by an alert student body. A prompt warning will head off trouble. It is possible in every school to have student and faculty minutemen patrolling the corridors on a schedule that will not interfere with necessary classes.

Along with the physical details set up in a building there is the matter of local community plans. Co-ordination with the rest of the city or town activities is essential, even imperative. If there is to be a siren to warn all citizens of an attack, or even for practice purposes, the school should operate on the same signal.

The Plan in Operation

With facilities and equipment in order, we are ready for work. One of the most important factors in defense is alertness. Minutemen must be active and wide-awake. Patrols must perform the duties assigned to them. There is no place in the whole program of civilian defense for guards to fall asleep or to be off duty. Again let us emphasize that the country is engaged in war with ruthless enemies. Since much of the school defense will be carried on by students and staff, the tempo of execution will need to be stepped up. We are not planning a basketball game or a class party. There is no time now for lengthy debates and a recital of opinions. The formality of leisurely procedure is to be abandoned for the emergency. Semimilitary movements are the order of the day. A consciousness of this new state of affairs will soon permeate the thinking of everyone in the building.

Frequent rehearsals will be necessary. If building evacuations are to be complete in three minutes after the signal, and some students are confused as to the proper exit to take, more training is needed at that point. Alertness, proper timing, good execution — these are the essentials.

Throughout the length and breadth of the United States there will be many differing conditions. School buildings range from one room up into the hundreds. Pupils range from kindergarten to old age, the latter being especially the case in cities where adult classes are in operation. There are the halt, the lame, and the blind. Some buildings are equipped with heavy machinery on different floors. Students should be routed away from such areas in case of danger. In planning the strategy of defense, pupils and staff may be gathered into designated quarters in the building or they may be sent home. Which plan is followed will depend some on the timeliness of warning, weather conditions, age of pupils, distances to travel, size of city, transportation facilities, and other factors peculiar to the locality. In cities where evening schools are in operation another problem presents itself. Blackouts will be in order. When the sirens sound throughout the city, calling for total darkness, all must obey. The school is only a unit in the activities of the city and must obey that signal. A signal for a blackout has the effect of a military order. There will be rehearsals on these. Before the first call comes for lights out in the city, all evening schools should rehearse the procedure. Here is a new situation. People cannot walk through darkened corridors and down stairways without danger of mishap. Some evening students are in advanced years. A building evacuation at night, with lights out, presents grave difficulties. Perhaps outside windows can be darkened and dim corridor lights left on. This would make travel safe without showing light outside. Flashlights may be needed. All this means thorough instructions to the student body as to use of facilities, the authority behind directions, and proper procedure. This matter of blackouts is peculiar to the evening school. A city-wide rehearsal, with a 20-minute test, might start with a siren warning and be followed immediately by a complete blackout for the whole community, started by pulling the light switches at the electric power plants. Schools must be ready. Since there will likely be some people on the evening school staff who are also on duty in the daytime, it would be well to co-ordinate day and evening procedures. This applies to building signals, itineraries of students, special danger spots that need to be avoided, caring for a massed group temporarily and any other items that are set up in the program.

Leadership

This is a real job for the school teacher. Some folks have referred to the schoolhouse as a cloistered place where students are conveniently taken for a time under the care of nice people who don't count in the real affairs of the community. Now comes the order for teachers to take over the job of protecting the lives of a quarter of the population and billions of dollars worth of property. It is an opportunity for real service and a great responsibility. School people cannot afford to muff the assignment.

Much of this work will fall to the men on the staff as they are more familiar with equipment and the dangers that may be met. Shop teachers, especially, will be called upon to take over many of the duties incident to the civilian-defense program. Whoever is assigned to this work should immediately set about to become informed on the important mechanical arrangements in the building. Conferences with the janitorial staff will be in order. Location of light switches, fuse boxes, building exits, signal systems — these are some of the things that must be understood.

There is the matter of co-ordination between the school and outside agencies. Some teacher may be assigned as a contact man between the school and community headquarters. Clear understanding and definite relations are necessary for efficient operation. The community may wish to instruct its citizenry in the essentials of a blackout and why such is necessary. The school is the logical agency to carry on the instruction. It may not be in the course of study, but the job must be done. Teachers have the advantage in this matter. The school is a formal institution, with machinery in motion for teaching people. The technique is already perfected. Time is available. We are called upon to do the job. It must and will be done. It behooves industrial and vocational people, especially, to acquaint themselves thoroughly with the machinery of operation in the building and to plan the necessary movements incident to safety measures. Qualities of leadership will come to the surface in all this. It is not just another assignment laid on the desk of a busy teacher. It is a call to service that none can shirk.

Conclusion

Now then, let us summarize the several points and complete the picture. There are some very obvious things to be noted. It would be unwise to predict what kinds of attack might come or in what area. Preparedness is the watchword. It is the responsibility of faculty, staff, and students to join hands in this matter of protection. This is the main business.

There are some other results coming from all this, so important that they rank almost on a par with the main objective. And these other things offer teachers an unusual opportunity. They are as follows:

a) Here is the chance to inculcate the ideals of Americanism. Perhaps we have grown a bit careless and have taken our liberty for granted. Let us, as teachers, stand foursquare

in our civic ideals and build up a body of young people who will radiate the spirit of a free country. What will it mean in each community to have this generation of students conscious of their duty as citizens, facing the problems of the day in the spirit of unselfish service, and sacrifice if necessary, in order that the democratic institutions we prize so highly may be preserved for those to come?

b) In this all-out for a common cause there is equality of opportunity. It is not a question of outstripping my neighbor in this matter of public service, but rather, outstripping myself. And the thought of equal opportunity has an ennobling influence.

c) We have grown a bit disrespectful of established authority. Old and young have flouted regulations for the common good. And this attitude is reflected in the younger generation. Here is a chance to build anew those splendid virtues so essential in a democratic community.

d) And what about public opinion? That great force that thrives in every group of intelligent people, shall it grow or perish? You teachers of America! Your great chance is here!

Suggestions for Defense Drawing Classes

JOHN F. SHAY*

The success of any adult-training program depends upon its ability to give to the student a feeling of achievement and success. The present engineering defense courses are no exception to the rule, and require skillful handling if they are to attain the desired results.

At the present time, there are a great number of training programs offering a variety of courses and directed by a college, or some educational center. As a rule, a large group will register for these classes because the idea of taking a college course appeals to many people, and that fact alone will attract a number of students. However, the glitter of the term "college" attached to the enrollment card soon wears off, and the job of keeping the students interested falls upon the teacher.

With the various types of adult programs under way at present, many men from industry have been introduced to teaching, and upon them falls the task of keeping the class going, and the work interesting and within the scope of the pupils. One of these courses, engineering drawing, is always in demand and popular with the students. This article aims to bring out a few points that may mean either success or failure. It is written mainly for the man who finds himself in a teaching position wherein he is *long* on practical experience, but *short* on teaching experience.

The First Class

Start the first night off with a bang! Know what you are going to cover in the course, and give a full account of what is to be required. Be honest with the group; don't try to talk anyone into taking the work, if they are not eager to do so. The alert teacher will capitalize upon any little personal touch that may arise, for much can be gained if the teacher exhibits a feeling of interest in the student as an individual. Show your students you have something to offer, and present it in so simple a form that they feel they will be able to do the work required. Remember that what may be a simple everyday occurrence to you will be new to them. Don't expect too much of them just because they are adults.

The use of sarcasm or ridicule in teaching young students may be poor practice, but it is fatal with adults. Not only is oral criticism bad, but checking papers too critically may also cause a decline in class enrollment. In grading the first few drawings, why not use either *satisfactory* or *rejected?* This will give you a chance to point out errors, and yet keep the student from becoming discouraged. "Nothing succeeds like success," definitely applies to adult schooling. I find that returning drawings full of red pencil corrections does not leave the student with much enthusiasm for the next problem. Using a check list to indicate errors puts the student in a more receptive mood to make the corrections on his drawing. This method also serves as a means of self-checking on the next problem. The following check list is used and stapled to the corner of the drawing:

Check These Points to Improve Your Drawing

Composition

1. Incorrect solution. Problem does not follow directions as given.
2. Faulty arrangement of views.
3. Make accurate measurements.
4. Keep drawing as clean as possible.
5. Keep views well balanced on sheet.
6. Title block must be correct — size, information, lettering, bill of material.

Shape Description

1. Object lines have been omitted or incorrect.
2. Line representing invisible edge omitted or faulty.
3. Object lines should be heavy and uniform in weight.
4. Dotted lines (hidden edge) should be lighter in weight and should be about ⅛ in. long with 1/16 in. space between.
5. Poor line work — lines are blurred, ragged, too heavy, partially erased.
6. Center lines omitted or improperly drawn. The center line should have the long line about ⅝ in. or more, and the short ⅛ in., with 1/16-in. space between.
7. Do not have a double line.
8. Make all corners neat and clear. Do not allow open spaces.
9. Wrong crosshatch lines, or poorly spaced, or omitted.

Size Description

1. Extension lines should not touch the object lines. Keep at least 1/16-in. space between extension line and object line. Carry extension line ⅛ in. beyond arrowhead.
2. Dimension figures should be ⅛ in. high with fractions 2/3 higher than whole number.
3. Dimensions are incorrect, omitted, or improperly placed.
4. Arrowheads should be ⅛ in. long and touch extension lines.
5. Fraction bar improperly placed.
6. Avoid repeating dimensions.
7. Keep dimension line at least ¼ in. from object line, and between lines.
8. Be sure the sum of the detail dimensions will be the same as the over-all dimension.
9. Whenever possible keep detail dimensions all in a straight line.
10. Dimensions do not read from bottom or right-hand side.
11. Notes are either omitted, or incorrect.

Lettering

1. Use all vertical, or all slant lettering.
2. Be sure of correct shape of all letters and numbers.
3. Use guidelines for all lettering.
4. Poor spacing of letters.

Comments

In using the list simply encircle the number indicating the type of error; underscore any particular portion of a statement.

Lectures and Demonstrations

If demonstrations and lectures can be supplemented by duplicated sheets, listing the main points discussed, the student will refer to a sheet of this nature more readily than a text. Use blueprints whenever possible, for there is a marked increase in interest when working from actual drawings, as compared with using a text for the same problem.

It is important for a businesslike operation of the class to get each class period started promptly. A good point to remember in this respect is to give a short talk on some part of the lesson of the evening, immediately after the class has been called to order. This will tend to get the students to class on time. This talk could easily be the directions for doing the evening's problem. Adults will be concerned about getting behind the rest of the group, and will be on time, if being late means being behind the others in the group. On the other hand, if the group is allowed to work by themselves for the first half hour or so of the period, tardiness will result. As the amount of tardiness increases, so will the

*High School, Latrobe, Pa.

number of absentees. Absentees, or late starters, are always a problem to the teacher, for it usually results in the teacher having to give extra individual attention to them in order to bring them up to the rest of the class. A duplicated sheet, giving the assignment for the course, will enable the student to work out of class, as well as allow the faster students to work ahead, should they desire to do so.

The amount of help offered a student will require good judgment and study on the part of the teacher. With some students, a teacher can become a bother, and may upset them more than help them, while others will need constant coaching, if anything is to be accomplished.

Freehand sketching may be a means of laying somewhat of a foundation before the actual board work begins. The advantage to sketching is that it takes less time for doing a problem, than it does to make the drawing on the board. However, there seems to be somewhat of a feeling against sketching with many men who have shop experience. This is possibly brought on by their acquaintance with the work of the engineer or draftsman. Therefore, they feel that if they are not working on the board and using all the equipment, they are missing the point, and are not getting what they think they should have. For the first few meetings give them problems that require the use of all their equipment, and work in the sketching gradually as they begin to see the reason for its use.

Care of the Equipment

The issuing and return of equipment may lead to some trouble if not properly checked. A method that will eliminate misunderstandings is simply to number the drawing kits and instrument sets. When issuing the materials, go over each one with the individual receiving them, and then have the recipient sign his name to the number. If the instructor simply issues the equipment and then puts down the student's name with the number, the pupil can come back with the answer that all the parts were not in the kit when he got it. By use of the afore-mentioned method, this is eliminated.

Although adult classes are run on a voluntary basis, and although ordinarily only interested individuals attend, occasionally one or two will turn up in a class who seem to be there for the social contacts rather than for the purpose of learning anything about the given subject. The teacher may probably hesitate to enforce any disciplinary measures on these adults. However, if they fail to cooperate, for the best interest of the class as a whole you can feel justified in asking them to discontinue the course. The time usually allowed for work of this nature is all too short, and having a disturber in the group hinders the progress of the class.

In evaluating the results of your teaching remember that you are dealing with a mixed group, so don't expect all the members of the class to reach the top. Because some will not do as good a job as others, however, does not mean that they are to be classed as failures. Don't present a discouraging picture to the students. Remember morale is a factor to be considered in dealing with the army in the classroom as well as on the field.

Industrial Arts in the Defense Emergency

G. B. WESTERBERG*

What is the place of the industrial-arts department in the present emergency? In what way can the department of industrial arts, no matter what grade, enter wholeheartedly into the matter of making worth-while and useful contributions to our program of national defense?

First of all we can be of great service by doing everything within our power to conserve all kinds of materials, and to release more men and material for defense purposes.

1. Our drawing paper may be used on both sides. If care is taken in laying out borders the plates may be neatly bound into booklets, if that plan is used, or they may be trimmed with equal success as when one side is used. It means about 50 per cent saving in paper.

2. Salvage sheet iron from old sign boards and tin cans. The saving that may be made here is in direct proportion to the amount of metal you use. Who is to say that as nice a tackle box or sand pail cannot be made from salvaged metal as from new, and that as much may be learned in the way of operations and related material?

3. Wood from old packing boxes has many uses. It will not be very attractive for certain articles, but there are many places where it may be used with good results and without loss of tool operations or related knowledge.

4. More time may be put in on certain home-mechanics jobs. There are literally hundreds of jobs about the home that dad will not find time to do with all his overtime work. He will not be able to hire a man to do many of them because men work long hours on vital defense projects. It must either go undone, be done in a slipshod manner, or be done by dad's son who is in junior high school, and is too young to go into industry but can nevertheless serve his country well by preparing himself well.

Following are some of the home-mechanics jobs that these young men may be taught to do in this emergency:

1. Repair and sharpen tools and utensils used about the home.
2. Do simple jobs of auto mechanics.
   a) Polish cars with various polishes.
   b) Remove and replace wheels on automobiles.
   c) Remove, repair, and replace tires and tubes on automobiles. Keep tires properly inflated (increasingly important to release more tires and rubber for industrial use).
   d) Remove dents from fenders and refinish with touchup enamel, or repaint fender to match body.
   e) Repair a cracked fender by means of patch, rivets, and solder.
3. Jobs in home upkeep.
   a) Replace washers in faucets.
   b) Replace faucets.
   c) Repair broken ironing cord or lamp cord, properly and safely.
   d) Replace a broken windowpane.
   e) Clean out a clogged drain by one of several methods that may be safely attempted by the home mechanic.
   f) Install window screens and storm windows.
   g) Repair the garden hose.
   h) Keep the garden tools in repair.
   i) Keep the lawn mower in repair. Sharpen the mower, or recondition it for use instead of getting that new one this year.
   j) Replace that drawer pull or refasten that hinge. If the edge of the veneer is beginning to loosen, fasten it before any damage is done.
   k) Upholster that chair instead of getting a new one just yet.
4. Jobs in farm upkeep, if you live on a farm.
   a) These are too numerous to mention; however, there are several good and several very inexpensive books on farm repair that may be had from The Bruce Publishing Company, of Milwaukee, Wis., The Manual Arts Press, of Peoria, Ill., and perhaps from many others.

Though we may be short of materials for the projects we have been making, there is no need to give up the ship. Smaller projects, reuse of materials in many cases, and the teaching of jobs in home mechanics that are of immediate and direct use, are a few of the ways that we may carry on our work even more usefully, perhaps, than with unlimited materials and equipment.

*Junior High School, Dundalk, Md.

Connecticut State Trade Schools Train Women for Industry

T. E. KEYES*

The training of women machine operators and inspectors for the National Defense Training Program is now part of the curriculum of the Connecticut State trade schools. In order to lessen the shortage of skilled workers in this section, and to stem the tide of in-migration of men from other areas, who might be left stranded and jobless with their families when the defense program is over, the Connecticut State department of education started the training of women as a possible source of labor reserve for this emergency.

Dr. Alonzo G. Grace, commissioner of education in Connecticut, was requested by manufacturers in Connecticut, in November, 1940, to train women for jobs in industry. Dr. Grace consulted with Augustus S. Boynton, director, bureau of vocational education, with the result that classes were started in many of the trade schools throughout Connecticut. This movement to train and employ women on skilled jobs is assisted by Major L. J. Maloney of the Connecticut State Employment Service; Albert F. Snyder, chairman of the Connecticut Manufacturers' Association Subcommittee, studying emergency defense labor problems; and E. A. Stowell, Connecticut representative of the Training Within Industry Division of the Office of Production Management.

The labor department of the Connecticut State Employment Service, with offices in the principal cities of Connecticut, and headquarters in Hartford, where a research office is maintained, devotes full time to the administration and interpretation of tests for applicants in the defense industries. Admittance to the Connecticut State trade schools for the defense industries is recommended to applicants successful in these tests.

A defense training course for women was initiated November 25, 1940, at the New Britain, Conn., State Trade School, on request of a New Britain manufacturing concern, asking that their women inspectors be upgraded. This course, which included blueprint reading, mathematics, and the study and use of precision measuring instruments, ran two nights a week, two hours a night, and was set up as a 40-hour course, but varied from 25 to 60 hours, depending upon the ability of the girl trainees. Seventy women completed this work which was of a supplementary nature. It is now more in the pretrade field, running, with 10 enrolled, mornings from 8 a.m. to 12 noon.

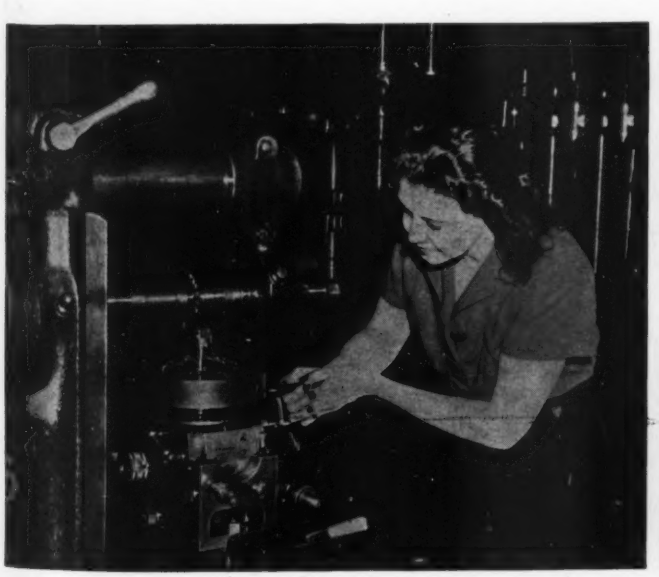
Manchester, Conn., State Trade School, on recommendation of a Manchester silk mill, started courses for women in January, 1941, at their Defense-Training Center No. 2, located near the mill. Twenty-six women were entered in a parachute-making course with a total of 151 trained, up to the closing date, September 1, 1941. Fourteen were trained in a parachute-assembly course and 156 were trained in a parachute shroud-line-making course.

The idea of training women for mechanical pursuits had its start in the Bridgeport, Conn., State Trade School in January, 1941, as was mentioned in the May, 1941, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, in an article entitled "The Bridgeport National Defense Training Program." The American National Red Cross Motor Corps, with the cooperation of the Bridgeport State Trade School, started an automobile repair course in which 50 women were trained 3 hours a night for 15 nights. In all, 4 courses were run with 16 enrolled in the first, 14 in the second, 15 in the third, and 10 in the fourth. All those who took this training are now enrolled as emergency drivers for the American Red Cross and are subject to call by that organization as a disaster squadron.

In June, 1941, after a survey was made of manufacturers in the Bridgeport section, asking how many would be interested in a proposed general machine course for women, results indicated that 40 to 50 women would satisfy the immediate need. As soon as the regular trade school classes went on vacation a course in machine work for women started August 4, 1941, in which 20 women were enrolled. This course was held from 8 a.m. to 5 p.m., 40 hours a week.

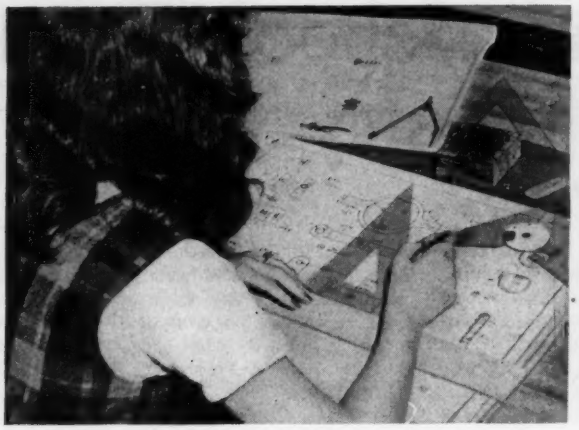
On August 30, 1941, 16 women were certified after 160 hours of instruction, twelve were placed immediately in 3 of the Bridgeport manufacturing plants. One shop took 6 as apprentice machinists; another took 3; two as milling-machine operators and one as an experimental assembler; another company

*State Trade School, Bridgeport, Conn.



This girl runs a milling machine as part of her instruction at the State Trade School, Bridgeport, Conn.

The surface grinder is another machine with which girls familiarize themselves at the State Trade Schools in Connecticut



The tracing course at Waterbury, Conn.'s Leavenworth High School, under the sponsorship of the Connecticut State Department of Education developed women in this important step in the reproduction of a drawing for a blueprint

This mixed group in machine training at the Bridgeport, Conn., State Trade School shows at the left, a boy on a shaper; center, a girl operating a lathe; and at the right, a girl at a drill press

took 3 as drill-press operators. Four of the women who took this preliminary training did not accept jobs, though offered, but preferred to further their training in a night class set up when day school took over the shop after vacation, on Sept. 2, 1941. The night class runs from 5 p.m. to midnight, and another class, for those unable to attend the earlier shift, runs from midnight to 7:30 a.m. Since the advent of this class, 10 more have been added to the roll.

These women are all given light machine-shop experience, which includes operation of drill presses, lathes, light milling machines, and benchwork. Related work in shop mathematics, trade theory, and blueprint reading, is part of the course.

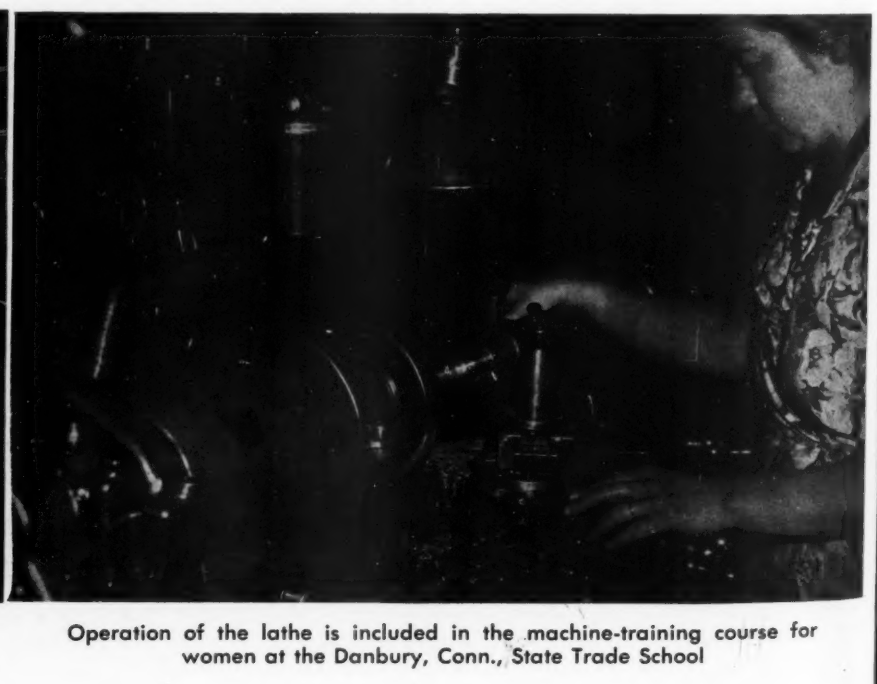
The average age of this first group was 25 years. None had had previous experience in machine work, yet the samples of work done during their training was equal, and in some cases, superior to that done by the men in training alongside them. Manufacturers employing these women claim they are working out very satisfactorily and forcing a speed-up in production. The average pay of those completing this course, to date, is 60 to 65 cents an hour.

Waterbury, Conn., made use of their Leavenworth High School when defense classes for women were started there on May 12, 1941, at the request of Waterbury manufacturers. The Connecticut State board of education sponsored a course in tracing for women which ran from May 12 to July 1, four hours a day, 20 hours a week, at which time it grew into a 40-hour-week course until August 18. Nineteen women completed 200 hours of this training, and 12 finished 300 to 400 hours of work in this field.

June 30, 1941, saw the opening of a course in machine training for women at the Boardman Trade School, New Haven, Conn., at the request of New Haven manufacturers, which lasted until August 22, 1941. As soon as a chair factory on County Street, New Haven, is renovated, these classes will be resumed, having stopped because of lack of room. While the high school in New Haven, adjoining the Boardman Trade School, was closed for the summer vacation, a room was temporarily acquired for this training, which included spot welding, soldering, and the running of lathes, milling machines, and drill presses.

In New Haven an attempt was made to give all-round experience, more, primarily, to

Mixed groups receiving training at the State Trade Schools, Bridgeport, Conn.



Operation of the lathe is included in the machine-training course for women at the Danbury, Conn., State Trade School

overcome shyness and nervousness on the part of the women in their new industrial environment. Graduates of this course have been successfully placed in New Haven, Milford, and Bristol, Conn., factories.

Machine training for women in defense industries started at the State Trade School, in Danbury, Conn., on July 7, 1941. Two women completed 147 hours' credit on August 16, 1941, and are now working in a Danbury, Conn., manufacturing company. Eight are now enrolled in this class, started because of a demand by the girls for the training. This is a 40-hour-a-week course and includes light machine training on lathes, drill presses, and milling machines. Stress is on the use of measuring instruments — micrometers, vernier height gauges, plug, ring, and snap gauges, and calipers. Some jig and fixture work and simple layout work are also covered. Women in the Danbury area are not as yet required for the operation of machinery.

Training women for shops in the defense industries was started at the Hartford, Conn., State Trade School, Sept. 8, 1941. Seventeen were enrolled on the first day; to date, 20 are enrolled. This course runs eight hours a day, five days a week, for five weeks. The 200-hour training which the Hartford women receive, includes work on the bench lathe, grinding machine, hand milling machine, drill press, foot press, spot welding, and soldering with gas, electricity, and the oxyacetylene tank. Related work with this course includes mathematics, blueprint reading, and the use of measuring tools and gauges, fitting the women for inspection work. It is expected that the enrollment will double in Hartford, and equipment is planned for that event. The ages of the Hartford group of women varies from 18 to 28, with most of them high school graduates, and one, a normal school graduate. Already 2 of the Hartford manufacturers have signified their intentions of taking the graduates. One manufacturer would like to have the training include work on power machines so that he could use the women in place of men on those machines, thereby releasing the men for heavier tasks in the shop.

Skills are a requirement today, and persons, men and women, whether younger or older, who do not have skill, can find employment only by acquiring that necessary skill. The Connecticut Bureau of Vocational Education released on June 26, 1941, a list of proposed types of work processes for a defense-training department for women. It includes: hand riveting, gun riveting, sheet-metal operations, soldering — hand iron, soldering — torch, soldering, electric iron, hand raising, drill press — single and double, hand tapping, machine tapping, hand milling, plain milling, power milling, hand-screw machine, B. & S. automatic screw machine, hand filing, foot press, buffing, bench lathes, floor lathes, spot welding, tool grinding, spray gun, straightening (flat), assembling and inspecting, measuring tools, blueprint reading.

On February 1, 1941, approximately 300,000 men had been trained in America for the defense training program but only 595 women were so trained. In Connecticut alone there are nearly 10,000 women registered on the unemployment roster and an additional 2000 on WPA. Many of these could be transferred to jobs in private industry with the right opportunities provided.

Course Outlines

Course Outline for Training Aircraft-Engine Assemblers and Testers

RAY F. KUNS*

The selection of the Cincinnati area as a likely spot for the development of factory facilities for the production of aircraft engines was influenced by several factors. One of these was the distance removed from coastal areas; another, the availability of transportation and materials; another, the nature of the industrial areas; and still another significant one, the state of development of the vocational high schools and their ability to contribute to the over-all picture.

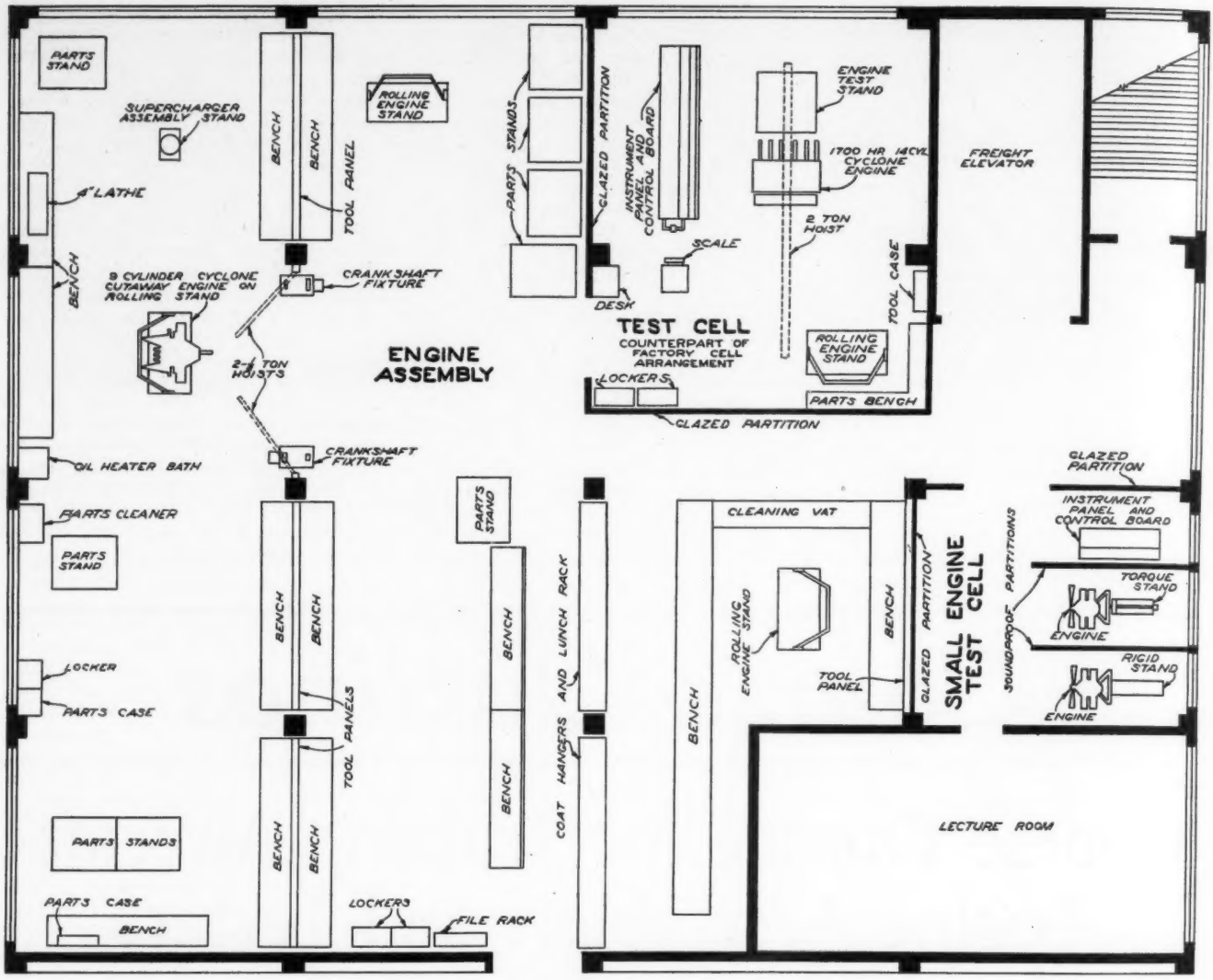
With the decision to locate a new plant near Cincinnati, the Wright Aeronautical Corp. selected an area immediately to the north of the city, and on this land has constructed what at the time was reputed to be the largest building in the world under one roof, the total amount of ground being just a bit short of 35 acres. Except for some of the office buildings, this is wholly a one-story plant. The foundry and certain other buildings are separate from the main building. The first engine was assembled approximately six months after breaking of ground, and six months later found the factory operating with approximately two thirds of the projected scale of employment.

*Supervisor and Co-ordinator in charge of National Defense Training, Cincinnati, Ohio.

Vocational Schools Problem

The factory established a school, in a leased building, for training machinists. This company school continues in operation, being wholly under the control of the factory. In the early months of operation men were assigned to the school without pay. At a later date, they were placed on the pay roll at the time of assignment. The usual length of time in this school is approximately three weeks, during which time a review of mathematics, blueprint reading, science, measuring instruments, and the like, is covered in one week, and two weeks are given to machine-tool operation. This short, intensive, refresher course on machines quite similar to those used in factory production, has proved quite satisfactory to the company. In addition, many machine hands, trained in national defense classes in Cincinnati, Norwood, and St. Bernard vocational schools, have been given employment.

The question of training aircraft-engine assemblers and testers was one which was of great concern to the firm's officials and engineers. Heretofore, such workmen had been trained within the factory by placing the *green* men alongside of experienced men. At no time in the history of the company had there been set up a program of training designed to do this job in a school. Production engineers and officials from the corporation visited the Automotive High School on several occasions in the fall of 1940, at which time preliminary plans were made for training such men as were to be needed as assemblers and testers. The company agreed to supply the Automotive High School with two of the engine models, which were to be made in the Cincinnati plant. These were the 14-cylinder, 1700-horsepower engines, valued roughly at $20,000 each. When it was suggested to these individuals that it would also be desirable for them to supply teachers to do this job, they stated that they did not have any personnel to release for such work. It was definitely established that the school would need to take over the problem of developing



Aviation Division, Automotive High School, Cincinnati, Ohio

the course of study, selecting and training the teachers, and assume full responsibility for the mechanics of the training program.

Since this was a wholly new art to the Cincinnati area, considerable thought was given to the methods of selecting and training the teaching personnel. Mr. K. C. Smith, an aircraft-engine instructor in the Automotive High School for 10 years, was asked to act as supervisor of the work. In December of 1940, the writer paid a visit to New Jersey to the Paterson plant of the corporation. On his return, he assigned Mr. Smith to a 10-day stay at Paterson, during which time he was taken through the plant and put through the routine of engine assembly and testing. A crew of 26 additional teachers and supervisors was recruited. These, in the main, are from the automotive shops of this area, many of them being graduates of the Automotive High School with some years of experience in automotive engine rebuilding and testing. This crew was started to work building benches, toolroom boards, selecting tools, and preparing programs of study, and two weeks later, on January 20, 1941, the school was opened. Considerable difficulty was encountered in securing the engines required, as well as locating and securing the tools needed. The guiding rule of not using obsolete engines or equipment was held to, in spite of lack of materials.

Those in charge of this training have held to the idea that there could be no justification in the use of obsolete tools and equipment in training of this type, and that only those operations which were common to the factory processes must be taught. The basis of all text material is the factory instruction manual on the model engine being handled. As new developments occur, they are immediately incorporated into the program of study. Thus it has been found that when a man trained in the school is placed on a job in the factory, the transition occasions no difficulties. The assembly of a crankshaft, for instance, is done in the factory with exactly the same jigs, dial gauges, and hand tools as those used in the school.

In order to speed the training of teachers, who incidentally were required to do a great deal of home study and to meet many times in conference, they were all sent to Paterson, N. J., for from three to five days' work in the factory. This was done in order that they might gain firsthand knowledge of factory procedures. As a result of these visits and factory training, the school training was stepped up to a marked degree.

The first program of training, originally set for 10 weeks, was extended to 13 weeks to make up for the lag occasioned by lack of equipment and difficulties of the organization of a new type of training. Of the first group of 226 certificated as having completed the requirements of the course, all but 13 were later employed in the factory. Of these 13, some were in the service of their country; some were on other jobs which they did not want to leave and a few failed to qualify for other reasons. The second group of trainees numbered over 300, and to date slightly more than 1000 men have been trained in the program, with over 300 remaining in training. Of the total number of men trained, approximately 90 per cent have been employed, and

placement of those eligible continues. Since this company is working on military aircraft engines, it is natural that a very high degree of checking and counterchecking is attendant upon the selection of any employee.

Occupational Tests for Selection of Trainees

All trainees are certificated through the state employment service. At the time of enrolling, they are given mechanical aptitude tests, requiring about two hours of their time. Later on, they are required to report to the school, at which time the Otis and Humm-Wadsworth tests are required, this taking approximately two hours additional time. Aside from the results of the two tests, the applicant's experience in allied work, his high school and college or technical school training, and other factors, are taken into consideration in determining whether or not the applicant should be afforded the opportunity of taking the training. Approximately one out of every two applicants has been given the training. Many factors aside from failure to qualify have entered into this. For instance, many men did not feel they could wait until there was an opportunity to take the training. Others had chances at other jobs.

Plan of Training

Owing to the nature of the subject to be handled and the number of men to be trained, the entire program was broken down into units, which have come to be known as benches, since this work in reality is a type of work best described as machinists' bench assembly. The nose section comprises one bench; the center section and valve action, another; the crankshaft, another, etc. In the school, men are rotated from one bench to the next, so that each man has a chance at all details of engine assembly. It is true that in the factory a man may be held at one point, doing only one unit of assembly; however, it is felt that he is a better workman for knowing all, and, furthermore, many trainees do have the task of completely disassembling and reassembling engines. Details of items covered on these benches appear on the outline of bench training, which follows. Twelve to 14 men are assigned to each bench, this being about the maximum number able to gather in a circle to receive instruction on some intricate part. In addition to the two original engines used for assembly, two complete new engines turned out in the Cincinnati factory are now available, and a considerable number of sections, such as the supercharger check, etc., are available for each bench. This is a much better plan, as it allows of more manipulative work for each trainee. While the school could have supplied many engines of the same make, but of different models, it has never done this, as operations do vary. At the end of one year of continuous training, sufficient aircraft-engine material is on the floor to permit of the desirable amount of manipulative practice.

Engine Testing

Testing of the 1700-horsepower engine is not a practical consideration for a school housed near the center of a city of 500,000 people. It was decided that the phase of engine training, which on the face of it appears to be the most vital one, could not be handled by the school. However, the exact duplicate of an engine test cell setup for handling these engines was provided. In this test cell, the engine is swung onto the test stand, all connections are made, and all manipulative operations in this connection are outlined and learned. For instance, the method of attaching a lifting hook or device, and the method of attaching chain block, are of importance. Methods of assembling cables and other fittings are vital. Purposes of instruments must be learned. Methods of calibrating instruments must be understood. Incidentally, the operation of engine testing has as a prerequisite, complete understanding of the manipulation of the slide rule. Consequently, much time needs to be spent on refresher work in mathematics, blueprint reading, graph projection, and data recording.

For those interested in the mechanics of testing this type of engine, a brief description is given. The newly assembled engine is sent to the test cell for a green test, which usually runs in the neighborhood of eight hours' operation under a rigidly specified set of conditions. A log is made covering a multitude of details. Neatness and exactness are prerequisites on the part of the trainess. At the conclusion of the green test, the engine is removed from the test stand, placed in the cradle, and rolled to the disassembly floor, at which time it is completely disassembled and cleaned, the parts being placed on tables on which they are taken to the inspection department. In the inspection department, where incidentally a goodly number of school-trained testers are now working, the engine parts are given a minute inspection for any flaws or faults developed during the green test. From the inspection department, the parts then go to the assembly floor, and are reassembled into an engine comprised of the original parts remaining in good condition, and others required to replace those found at fault. After the reassembly, the engine is returned to the test cell for a shorter run in what is known as the final test. If in this test the engine incurs any penalty, it has a teardown, reinspection, and penalty rebuild, when it is again rated for final test.

In spite of the fact that it is not possible to make actual running tests of these large power plants, records in the factory do show that men trained as testers have been uniformly satisfactory when placed on the job. When compared with those who have had their test training in the factory alone, the thoroughness of training in the school offsets the disadvantages of not having the actual operation of the engine, which is the lot of those trained in the factory. The difficulty with the factory-trained tester seems to be his lack of understanding of why he does the operation he is required to do. There seems to be no question that the best way to train engine testers would be a combination of time spent in the test cell and the thorough-going training which is given at the school. While this is the eventual outcome, there is no chance at present for the trainee to go to the test cell until he is actually on the pay roll, and there has been no attempt at upgrading the factory trainee by bringing him back to the school. Perhaps time will solve some of these difficulties, but it can safely be said that the training, as outlined and given, has proved to be most valuable indeed in stepping up the production of engines in the factory.

The reader will note an outline of both the assembly and test procedure, in that which follows, with references to training in the school. The layout of the area in which this work is conducted appears in the drawing reproduced herewith. The reader should remember that this training has been given in three shifts daily for approximately one year, all training being of the pre-employment grade requiring 30 hours per week for 10 weeks.

Production Engine Test Training Outline

I. The Engine Tester

A. *Aviation High School requirements for test trainees*
1. The school application.
2. The O.S.E.S. aptitude tests.
3. The temperament tests.
4. A high school education or better.
5. Physical fitness.
6. Full American citizenship.
7. Good moral character.
8. F.B.I. cleared record.
9. Perfect attendance.
10. Complete cooperation.

B. *What the engine tester accomplishes*
1. Runs or wears in new parts.
2. Checks engine performance compared to specification.
3. Discovers and reports weakness developed during tests.

C. *Responsibilities of engine testers*
1. To advance himself and be worthy.
2. To aid the instructor in accomplishing the best instruction.
3. To support the name of Aviation High School with fine work.
4. To prepare to help Wright Aeronautical Corp. maintain its good name.
5. In all these things to maintain a patriotic American spirit.

D. *Methods of accomplishing our aims*
1. Be prompt.
2. Be serious.
3. Be clean.
4. Be neat.
5. Give your whole attention.
6. Take copious notes.
7. Forget your self(ishness).
8. Tolerate dishonesty in no one.
9. Give so that you may receive.

II. The Internal Combustion Engine

A. *History and development*
B. *Nomenclature*
1. Force, work, energy, power.
2. Horsepower — brake, indicated, frictional.
3. Friction.
4. Efficiency — mechanical, thermal.
5. Compression, compression ration.
6. Torque, torque reaction.
7. Inertia.

III. The Principles of Internal Combustion Engine Operation
1. The four-stroke cycle.
2. Cams and valves.

3. Simple valve timing.
4. Engine nomenclature.
5. Explanation of the above with cutaway Cyclone E.

IV. Carburetion

1. Definition of carburetion.
2. Theory and illustration of simple carburetor.
3. Air-fuel ratios, how determined and their importance.
4. Float and floatless carburetors (Holley and Stromberg).

V. Ignition

1. Elementary principles of electricity.
2. Elementary principles of ignition.
3. Ignition systems.
4. The magneto.
5. Ignition timing and its great importance.
6. The compensated cam-type magneto.

VI. Lubrication

1. Definition of lubrication.
2. The S.A.E. numbering system.
   a) Viscosity.
   b) Fire point.
   c) Carbon.
   d) Pour point.
   e) Ash.
   f) Acid.
3. Factors affecting the selection of an oil.
4. Diagram and explanation of dry pump oiling system.
5. Explanation of the oil system parts.
   a) The tank.
   b) The hoses and connections.
   c) The gear pump, the relief valve.
   d) Drilled and fitted passages.
   e) The dry sump.
   f) The scavenger pump and system.
   g) The filters.
   h) The oil coolers.
   i) Floating wearing parts on oil film under pressure.
6. Need of absolute cleanliness.
7. Effect of water in the system.

VII. Fuels

1. Composition of gasoline fuels.
2. Types and grades.
   a) Gravity, Beaume.
   b) Boiling characteristics.
   c) Freezing characteristics.
   d) Heat values.
   e) Knock characteristics.
3. Relationship of octane rating to compression ratio.

VIII. Engine Cooling Systems

1. Direct-air cooling.
2. Indirect (liquid) cooling.
3. Oil as a cooling agent.
4. Heat loss through cooling system. Takes so much air to cool an engine.
5. Use of baffles in direct air cooling to cool where cooling is needed.
6. Necessity of having perfect cowling and baffle installations.

Test Procedure — Outline of Course by Weeks

First Week

1. Preliminary lecture.
2. The internal combustion engine — "Power Plant Manual."
3. The internal combustion engine — "Power Plant Manual."
4. Lubrication and fuels — "Power Plant Manual."
5. Carburetion and ignition — "Power Plant Manual."

Second Week

1. Correct use of tools — safety instructions.
2. Engine setup.
3. Engine setup.
4. The instrument panel.
5. The rear section chart — work sheet.

Third Week

1. Mathematics necessary for production engine testing.
2. Slide rule.
3. Barometric pressures.
4. Barometric pressures.
5. Weekly examination.

Fourth Week

1. Manifold pressure. Standard test speeds.
2. The power chart.
3. Carburetor air. Determining observed horsepower.
4. The production test — work sheet.
5. Weekly examination.

Fifth Week

1. Oil flow.
2. The fuel specific.
3. Oil specific.
4. Oil specific.
5. Weekly examination.

Sixth Week

1. Use of the right length propeller.
2. The final test, the penalty test — work sheet.
3. Temperatures.
4. Pressures.
5. Weekly examination.

Seventh Week

1. The engine checks.
2. The check run.
3. Detail instruction as per log-sheet headings limits.
4. Detail instruction as per log-sheet headings.
5. Weekly examination.

Eighth Week

1. Starting the engine — work sheet.
2. Log sheet.
3. Engine-testing technique — "Cassidy's Manual."
4. Oil flow correction.
5. Weekly examination.

Ninth Week

1. Review — review questions.
2. Review — review questions.
3. Review — review questions.
4. Review — review questions.
5. Review — review questions.

Tenth Week

1. Review — review questions.
2. Review — review questions.
3. Final test.
4. Make log sheet.
5. Make log sheet.

Assembly Procedure — Bench No. 1

First Day

1. Lecture on nomenclature theory of C 14–B Cyclone engine. — Three hours.
2. Disassembly and explanation of the proper handling of tools and engine parts. — Three hours.

Second Day

1. Disassemble and give instruction on proper use of engine stands, chain hoists, parts stands, and safety precautions. — Three hours.
2. Assembling main sections to stand and timing the cam gears. — Three hours.

Third Day

1. Installing cylinders (wiring harness, radio shielding) and air deflectors. — Three hours.
2. Installing push rods, rocker arms, cover tubes, and adjusting valves. — Three hours.

Fourth Day

1. Installing supercharger, nose section, intake pipes, and oil sump. — Three hours.
2. Installing and proper use of top dead-center indicator and timing dial. — Three hours.

Fifth Day

1. Lecture on installing magnetos and checking of the valve timing. — Three hours.
2. Installing magnetos and checking valve timing. — Three hours.

Sixth Day

1. Tear down with instructions to speed up. — Six hours.

Seventh Day

1. Complete assembly make all necessary checks and adjustments. All operations checked against time and accuracy. — Six hours.

Eighth Day

1. Review and complete any operations necessary. — Three hours.
2. Test and discussion of wrong answers. — Three hours.

Assembly Procedure — Bench No. 2

First Day

1. Lecture on the nose section, duties and method of inspection section, proper use of small tools, and procedure of safety wiring and cotter pining. — Three hours.
2. Disassembly of C–14–A nose section (solid-type bearing). — Three hours.

Second Day

1. Complete disassembly and assembly of model C–14–A nose section — study of oil flow while disassembling. (split-type bearing). — Six hours.

Third Day

1. Complete disassembly and assembly of model C–14–A nose section. — Six hours.

Fourth Day

1. Disassembly and assembly of model C–14–A nose section (solid-type bearing). — Three hours.
2. Inspection of assembly. — Three hours.

Fifth Day

1. Assembly and disassembly of model C–14–A (split-type thrust bearing). — Three hours.
2. Inspection of parts for mutulation and inspection of assembling. — Three hours.

Sixth Day

1. Disassembly of model C–14–A split-type bearing. Stoning and cleaning parts. — Three hours.
2. Stoning and cleaning parts assembly of model C–14–A split-type bearing section. — Three hours.

Seventh Day

1. Disassembly and assembly of model C–14–B nose section. — Three hours.
2. Disassembly and assembly of governor, drive case, and safety wire practice. — Three hours.

Eighth Day

1. Disassembly and assembly of C–14–A (split-type bearing) C–14–A (solid-type bearing) or C–14–B nose section. — Three hours.
2. Examination. — Three hours.

Assembly Procedure — Bench No. 3

First Day

1. Explain method of grading of enrollees, also stating rules and regulations of the school. — One hour.
2. Mathematics. — Five hours.

Second Day

1. Lecture on theory of internal combustion engines, explained on cut-away 9-cylinder Wright engine. — Three hours.
2. Men assigned to various jobs on bench such as disassembly and assembly of front-and-rear main section, oil pumps, dual accessory drive, safety wiring and handling of tools. The main objectives of this work is to familiarize students

with different pieces of equipment and tools. — Three hours.

Third Day

1. Lecture on uses of various hand tools, gauges, and measuring instruments. — One hour.
2. Men assigned to various jobs to help them acquire the proper use of tools, and to familiarize them with the different units, that will be taken up at bench No. 3. — Two hours.
3. Men assigned to disassemble and assemble front-main section and rear-main section. — Three hours.

Fourth Day

1. Lecture on the uses of and disassembly and assembly of the front and rear-main sections, also state oil-flow through each section. — One hour.
2. Men assigned to disassemble and assemble front-main and rear-main section. — Five hours.

Fifth Day

1. Lecture on the construction of the oil pump, oil flow, action of pump, and lubrication of engine. — One hour.
2. Men assigned to disassemble and assemble oil pump. Emphasis put on safety features of safety wiring, different types of wiring, and easiest way of wiring. — Five hours.

Sixth Day

1. Lecture on dual accessory drives, its duties, and the various jobs that can be performed indirectly by D.A.D. — One hour.
2. Men assigned to disassemble and assemble dual accessory drive. Particular attention is paid to various types of bushings and their uses and actions. — Five hours.

Seventh Day

1. Lecture on safety wiring methods, its uses, easiest ways, etc. — One hour.
2. Open discussion on all previous lectures and various difficulties encountered during week of work. — One hour.
3. Men assigned to disassemble and assemble rear-main section. — One hour.
4. Men assigned to disassemble and assemble oil pump. — One hour, thirty minutes.
5. Men assigned to disassemble and assemble dual accessory drive. — One hour, thirty minutes.

Eighth Day

1. Review of mathematics. — Three hours.
2. Writing test, covering all subjects taken up during seven days. — Three hours.

Assembly Procedure — Bench No. 4

First Day

1. Lecture on handling of parts and use of tools. — Two hours.
2. Disassemble supercharger and nomenclature. — Four hours.

Second Day

1. Supercharger disassembly. — Two hours.
2. Explanation of operation of high-speed clutch and assembly, of high-speed clutch and supercharger. — Four hours.

Third Day

1. Disassemble supercharger. — Two hours.
2. Explanation of operation of low-speed clutch, and assembly of low-speed clutch and supercharger. — Four hours.

Fourth Day

1. Disassemble supercharger. — Two hours.
2. Inspection of parts removing scratches and nicks and assembly of supercharger. Checking all clearances. — Four hours.

Fifth Day

1. Disassemble supercharger. — Two hours.
2. Explanation of selector valve, and assembly of supercharger. — Four hours.

Sixth Day

1. Disassemble supercharger. — Two hours.
2. Explanation of operation of drain-valve assembly, and assembly of supercharger. — Four hours.

Seventh Day

1. Disassemble supercharger. — Two hours.
2. Explanation of cuno oil cleaner, and assembly of supercharger. — Four hours.

Eighth Day

1. Disassemble and assemble supercharger. — Four hours.
2. Test. — Two hours.

Assembly Procedure — Bench No. 5

First Day

1. Lecture on handling of parts and tools. — One hour.
2. Disassemble crankshaft unit. — Five hours.

Second Day

1. Nomenclature, by practical demonstration. — Two hours.
2. Assemble crankshaft. — Four hours.

Third Day

1. Disassemble and assemble crankshaft. — Six hours.

Fourth Day

1. Disassemble and reassemble front and rear crankshaft sections. — Three hours.
2. Assemble crankshaft. — Three hours.

Fifth Day

1. Disassemble and check all parts for nicks and scratches. Remove same and polish with crocus cloth. — Six hours.

Sixth Day

1. Lecture on oil flow. Trace oil flow through crankshaft. — Two hours.
2. Assemble crankshaft. — Four hours.

Seventh Day

1. Disassemble and reassemble rear main case. — Three hours.
2. Disassemble crankshaft. — Three hours.

Eighth Day

1. Assemble crankshaft. — Three hours.
2. Test. — Three hours.

Assembly Procedure — Bench No. 6

First Day

1. Lecture on material used in the manufacture of piston rings. Discuss purpose served in engine and how they receive their lubrication. — One hour.
2. Demonstration as to the proper method of disassembling and reassembling of piston rings on the piston. — Five hours.

Second Day

1. Lecture on material used in the manufacture of pistons. Discuss purpose served in the engine and the method of lubrication. — One hour.
2. Demonstration as to the proper method of checking side clearance of rings in the groove and end gap clearance in the cylinder bore. — Five hours.

Third Day

1. Lecture on measuring instruments. — One hour.
2. Show practical use of inside and outside micrometer-dial indicator, and inside and ouside calipers. — Five hours.

Fourth Day

1. Lecture on material used in the manufacture of the cylinder head and barrel. The methods of joining the two parts together also the installation of other small parts in the head by expansion and contraction. — Two hours.
2. Practical experience as to the proper method of checking the clearance between the piston and cylinder bore, using inside and outside micrometers. Installing rings on piston, and replacing pistons in cylinder. — Four hours.

Fifth Day

1. Lecture on material used in the manufacture of piston pins and the purpose they serve. — One hour.
2. Trainees instructed to disassemble and reassemble piston pin in piston. — Five hours.

Sixth Day

1. Lecture on material used in the manufacture of exhaust and intake valves, also the method of cooling them, and the purpose they serve in the engine. — One hour.
2. Trainees instructed as to the proper method of disassembling and reassembling of valves in the cylinder. — Five hours.

Seventh Day

1. Lecture on material used in the manufacture of rocker arms, the method of lubricating them, and the purpose they serve in the engine. — One hour.
2. Trainees instructed as to the proper method in disassembling and reassembling of rocker arms in the cylinder. — Five hours.

Eighth Day

1. Review of work performed on the previous seven days. — Three hours.
2. Written test. — Three hours.

EQUALITY AND LIBERTY

Fundamentally, equality means the equality of all in respect to civil, economic, and political rights and equality before the law. It does not mean, and could not possibly mean, equality of individual ability, of individual capacity for achievement or in value of individual service to one's fellow men. Considerations of physical strength and health, of mental inheritance and equipment, and of environment, from all of which difference of opportunity arises, make such equality wholly impossible. No two individuals are ever exactly alike, and unless they were exactly alike, they could not possibly be equal in this mechanical sense. We see something which approaches mechanical equality among those confined in prison or those compelled to work either with hands or with brain under conditions rigorously imposed by a dominant power. Among a people which enjoys liberty, equality quickly reveals itself by the rise to positions and opportunities of steadily increasing importance of those men and women who exhibit exceptional ability and capacity for achievement. In the industrial history of the American people there are illustrations without number of the capacity of the individual, given his opportunity, to rise to positions of high administrative power and responsibility solely by use of that equality of opportunity which our free institutions offer to him. Of those who are at the present time the chief administrative officers of 12 of our greatest railway systems, five began their service as clerks, two as office boys, and one each as fireman and engineman, as track laborer, as stenographer, as telegraph operator, and as rodman. This record tells its own story of the opportunity which is open to excellence. Many other similar instances could be found by an examination of our industrial and commercial organizations. — *Nicholas Murray Butler.*

Aircraft Riveting and Assembling Course

F. L. NOVASCONE*

In 1938, Mr. J. C. Woodin, Wichita's far-seeing supervisor of vocational and industrial education, anticipated a demand for trained men in the local airplane factories and decided to do something about it. His first step was to add a course in sheet metal in the vocational department of Wichita High School East. Then, with the assistance and backing of Mr. Laurence Parker, state supervisor of vocational education, he organized night classes in machine shop, welding, aircraft sheet metal, and blueprint reading for men employed in the airplane factories.

Both men worked diligently on the program and their work soon began to bear fruit. The personnel of the local airplane factories were very much interested. They realized the value of such a program and immediately demanded a part in it.

Mr. Woodin grasped this opportunity and organized a strong advisory committee composed of the leading men of the aviation industry and a group of picked vocational instructors. This committee set up qualifications for trainees and the standards and skills to be met before the factory would accept them. The factories also donated tools, machinery, and material to insure the success of the undertaking.

By the spring of 1939, the program had received the wholehearted support of the public and the aviation industry. While most schools shut their doors in June after a long year's work, the vocational department of Wichita, Kans., was throwing theirs open to an eager group of selected young men intensely interested in the aircraft industry. By the end of the summer of 1939, several hundred more young men had been trained and placed in the factories.

With the opening of the regular school session the factories had to forsake their full-time program and accept short night and Saturday classes for training their men.

When the spring of 1940 arrived, the program was again put on an 8-hour basis, six days a week. July 1, 1940, the Federal Government stepped in and took over, accepting this program as one, if not the first, school of National Defense Training. Additional money was appropriated and the program greatly increased.

A rough idea of the size of the program can be obtained by examining the records of the school from July 1, 1940, to December 31, 1941. During this time 9675 trainees were enrolled, 6960 completed training and out of these, 6579 were placed in employment. These figures will probably be doubled in 1942.

The department that played a major part in this phenomenal rise of the training program was the aircraft sheet-metal shop. From a class of 20 boys with one instructor in 1938, it has grown to a class which numbers more than 1000 students under a teaching staff of 40 selected instructors. These instructors are men approved by the factory personnel. They possess both factory experience and the ability to teach. Their combined experiences were obtained as employees of many of the airplane factories in this country. The aircraft sheet-metal course being used in the school is the result of the combined effort of

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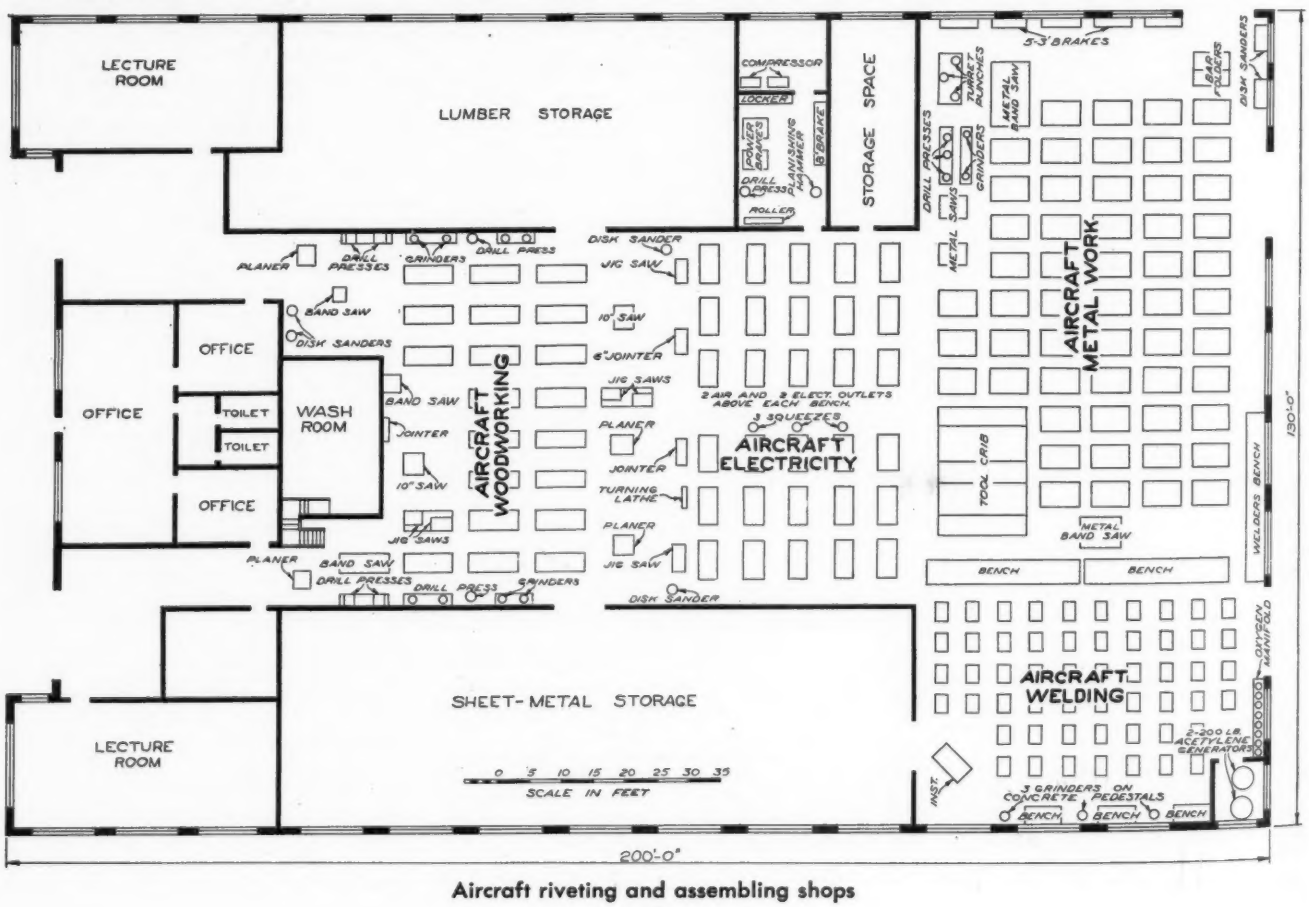

Aircraft riveting and assembling shops

these instructors. To them goes the credit of training and placing over 6000 men in highly successful jobs in the past year. They will also bear the brunt of training the anticipated 15,000 more trained workers, both men and women, in 1942.

Before going into the details of the aircraft sheet-metal course of study, it might be interesting to note what procedure an in-coming trainee must follow to enroll in the Wichita National Defense School. A study of the induction sheet used by the school, may be interesting.

Trainee's Name..... Date..... Assigned.....
Last First Middle Instructor

NATIONAL DEFENSE TRAINING SCHOOL
Wichita Public Schools
Wichita, Kansas

Induction Sheet
Check Sheet for Induction of Students:

	Date	*Sign*
1. Employment Service refers boy to school with E. S. 320 card,	.....	.....
2. Application blank is filled out by applicant if not already filled out at E. S.	.....	.....
3. Application is checked by enrollment clerk; doubtful cases are referred to supervisor.	.....	.....
4. Applicant interviewed by supervisor and O.K'd or rejected.	.....	.....
5. Applicant is given medical blank and referred to M.D. for examination.	.....	.....
6. Office work card is made and filed in temporary file.	.....	.....
7. Applicant returns after medical report has been received by the school.	.....	.....
8. If medical is O.K., applicant is assigned to class by secretary at desk.	.....	.....
9. Notation of acceptance or rejection with date is made on E. S. 320 card when returned to E. S.	.....	.....
10. Applicant is supplied with badge, tool checks ($1 deposit), time card, and student bulletin. Record is made on card file of badge issued.	.....	.....
11. Applicant, with application, medical and induction sheet, reports to head instructor who explains aims, requirements, standards, tools needed and assigns trainee to instructor.	.....	.....
12. Instructor places trainee on his class roll, makes out progress sheet, and assumes responsibility for training, attendance, etc.	.....	.....
13. Instructor returns application blank to office within 24 hours.	.....	.....
14. Office makes out a VE–ND 1 card, with signal attached, which is filed according to code. Office work card is transferred to active alphabetical file.	.....	.....
15. A "Report on Tryout" (form 3), is made out and filed behind date. This form is to be sent to instructor two weeks from date of enrollment.	.....	.....
16. VE–ND file is checked twice a month to check on trainee in program too long.	.....	.....

After enrolling, the trainee selects one phase of the sheet-metal course which he wishes to learn. At this writing, there are six different training units in which men can be made employable: riveters, brake men, shear men, layout men, inspectors, and assemblymen. The instructor informs the in-coming trainees which type of men the factory is hiring, and the trainee usually selects this training unit first. If the instructor finds the trainee cannot do the work, he usually transfers him to another unit before dropping him. As soon as the trainee becomes employable and there is an opening in the plant, he is graduated and placed. If the factory does not need men the trainee is given the full sheet-metal course for the all-round trained man is in great demand at the plants. A well-trained aircraft sheet-metal worker can be transferred at will without hindering production. They also make excellent crew chiefs and lead men.

The greatest demand at present and probably in the future has been for riveters and assemblymen. Since over 90 per cent of the men trained take the riveting and assembly course, these units will be presented in detail and the others ignored.

The riveting and assembly course has been continually revised for the past three years. The process of revision is still in progress. At present it consists of the following problems that have been selected to train the men to become skillful with the tools which a riveter and assemblyman must use.

Job No. 1: Lay out and drill a 3 by 6-in. rivet plate.

From this job the student learns the use of the scale, which he will be required to read accurately throughout his work. Each student becomes familiar with the electric and air motors, which as a riveter he will be required to use with speed and accuracy. It is absolutely essential that the student *master* this skill before attempting any other project. The same care and accuracy must be exercised in all future assembly work.

Job No. 2: Make a 3 by 6-in. hand riveted plate using (*a*) 3/32 or 1/8-in. r.h. rivets, (*b*) 1/8-in. brazier head rivets.

This type of riveting is used in fitting Dzus springs and in riveting on gas tanks. Though most rivets are driven by mechanical means, it is sometimes practical to drive them by hand under certain conditions and on certain parts.

Job No. 3: Make a brazier head gun rivet plate.

Brazier head rivets are usually driven on the skin of an airplane. Since skin gauges are comparatively very thin, these rivets must be driven without nicking the rivet head, set marking the metal, or slipping off the head of the rivet. Any one of these happenings would probably ruin the entire sheet.

Job No. 4: To make a countersunk rivet plate.

Wherever the heads of other type rivets interfere with the close fit of parts, countersink rivets are used. These may be driven with a smooth faced hammer by an experienced man exercising considerable care; however, better results are usually obtained by using a flush set, of a 1/4-in. short punch.

Job No. 5: To make a flush riveted plate.

When riveted airplane parts must have a smooth surface on one side and the metal is too thin to countersink without enlarging the hole, then dimple riveting is used. Dimple riveting is where all the sheets being riveted are dimpled to allow the head to set flush on the outside. The popularity of this type of riveting is increasing greatly among manufacturers of military aircraft. Dimpled holes must be watched closely to make sure that small cracks are not started on the under sheet.

Job No. 6: Make a riveted I beam using a compression riveter.

This project may be considered as the first assembly job. The trainee learns how to operate a squeeze riveter.

Job No. 7: To make an angular I beam.

The purpose of this project is additional riveting practice, and learning to buck rivets in difficult positions. Guard against too little edge distance on any of the parts.

Job No. 8: Make a spar.

This job requires advanced bucking and riveting ability. It employs joggle forming as an exercise and also provides good assembly experience.

Job No. 9: To make a skin riveting panel.

First with AN455AD 3–3 rivets and AN455AD 4–3 rivets, second with AN425AD 3–3 rivets and AN425AD 4–3 rivets by flush riveting. This is the first job giving skin riveting practice.

Job No. 10: Build a Denton box. This gives practice in blind riveting.

Many rivets must be driven where the bucker cannot see the bar in airplane parts such as fins, rudders, ailerons, flaps, etc.

Job No. 11: Make a compression member.

For the benefit of those trainees who will be employed in subassembly, the compression member section was designed. It is typical of many of the smaller assemblies which make up a plane. A compression member on a plane is a stress bearing assembly and must be put together carefully.

Job No. 12: Make a Davidson panel using extension drill and offset rivet sets.

This project has been designed for the following purposes:

1. It provided practice with straight and offset rivet sets.

2. Practice is provided for two men working together: one driving the rivets and the other bucking.

3. It provides practice with an extension drill.

Job No. 13: To make a nose section.

Leading edge assembly of any control surface. This job involves several new aspects of assembly and all of the previous skills learned.

Job No. 14a: Make a tab.

A style of riveting known as cupped riveting is used in the trailing edge. The driven head is in the slip stream and is cupped for less resistance. Extreme care must be used to get cupping close around edges without set-marking the skin. Due care must be taken in selecting proper length rivets for ribs, and buck them in narrow part of the rib.

Job No. 14b: To make a rudder tab.

Advanced cupping practice on heavy gauge metal. Heavy metal must be drilled straight and sufficient edge distance maintained. This project is designed from an actual airplane part.

Job No. 15: To make a panel of AN455AD 4–4 rivets.

A panel is a sheet of metal strengthened by angles or channels. This project gives practice in framing, skinning, and riveting very similar to actual wing or fuselage construction.

Job No. 16: Make a cylinder skin-riveting project with .020 material.

This is skin riveting and offset practice, rolling practice, and assembly.

Job No. 17: To make a fuel tank.

Considerable difficulty will be encountered in driving A17ST rivets through soft metal, such as the nonheat-treated bulkheads; however, this is sometimes done in the factories on certain parts, and every employee qualified as a riveter is expected to be able to do so satisfactorily. The secret of a neat job is to get a good job on the first rivet in each hole.

Job No. 18: To build a Boeing-type spar.

This project is especially designed to give the trainee practice in a variety of assembly and riveting operations. The Boeing ship uses a truss-type spar and rib very similar in many respects to the construction of this piece.

Job No. 19: Make a Beechcraft flap ½ size.

This project includes many of the skills learned up to this point in the course. Careful, accurate work is required to build this part up to aircraft factory standards of workmanship.

Job No. 20: Large skin-riveting test panel.

This project has been used successfully to test the ability of the advanced trainee to drive the various types of rivets used in skin riveting. It is a two-man project, one driving and one bucking.

Job No. 21: Corrugated material projects.

The Boeing airplane uses a sheet of corrugated material between the skin and the rib structure. These projects provide practice in working with aluminum alloy sheet in this form. Very careful work is required if the skin is to appear smooth when riveted to the corrugated reinforcing material.

With this shop training the trainee also receives a series of lectures. This related information is summed up under 14 general headings as follows:

1. Safety
2. Correct shop practice
3. Tools and machines
4. Aluminum and its alloys
5. Metal fasteners
6. Drills and drilling
7. Riveting
8. Shop mathematics
9. Blueprint reading
10. Assembly procedure
11. Brake work
12. Forming metal
13. General airplane construction
14. Factory routine and practice

These topics are discussed in detail with the class; thus, if a trainee is placed on the job after being trained in one unit only, he has a general understanding of the other phases of aircraft sheet-metal work.

Before going to work a trainee is given a list of tools he will need to perform his job. The instructor also gives him firsthand information concerning the department the man is going to work in.

There is one important factor which has definitely put this program across. It was the factory atmosphere that Mr. Woodin insisted must prevail in the program; thus bridging the gap between school and factory. This has been accomplished. The school has three shifts: 8 a.m. to 3:30 p.m., 4 p.m. to 11:30 p.m., and 12 midnight to 7:30 a.m., seven days a week. Guards are on watch at the doors and no one is admitted into the shop without a badge. The trainees punch time clocks, have their own tool checks, and follow the same routine they will have at the factory.

The program is kept very flexible to conform to the demands of the factories. It can be easily stepped up or decreased, depending upon the demand for men. There is no fixed length of the course, only a level of skill required to do the job is strictly adhered to.

The school is now training women who must take the place of men who will be drafted. These women are trained to do certain specified jobs selected by the factory that is to employ them. At this writing the Boeing Airplane Co. has sent an order for six hundred women to be trained in drilling only. The company has informed the school exactly what skills these women must acquire before being sent to them.

A check-up system whereby graduates of other schools are tested has been set up at the request of the factories. The check-up runs from one to three days, at which time the man is either declared employable or recommended for more training.

It is extremely difficult to endeavor to portray clearly the scope of work of the Wichita National Defense School in this brief article. One must visit the school to realize the real part it is playing in the production of trained men for our all-out program for 60,000 airplanes for 1942.

NOTES ON TRAINING ENGINEERS FOR AIR CONDITIONING

R. H. PHILLIPS*

A. *Situation in the heating and ventilating field when air conditioning emerged:*

1. Engineering for older types of heating and ventilating fairly well standardized, and often on rule-of-thumb basis.

2. New and different types of applications required engineers with more comprehensive knowledge than generally found in the industry at that time.

B. *Relief of this condition supplied at the start by:*

1. Restriction of most air-conditioning work to larger type of installations and those in the industrial field.

2. Manufacturers doing their own engineering and contracting.

C. *Gradual public acceptance resulted in:*

1. Demand for application to smaller jobs.

2. Smaller contractors entering the field.

D. *Need for large number of trained engineers for contractors arose since:*

1. All buyers of air conditioning could not retain professional advice through architects and consulting engineers.

2. Direct engineering aid on all jobs by manufacturers impossible.

Training of Engineers for Contractors

A. *Necessity for it*

1. Help to improve public reaction and acceptance of air conditioning by improving quality of jobs without disproportionate increase in costs through:

a) Over-all design best suited to customer's requirements and capacity.

b) Proper co-ordination of various factors of air handling, refrigeration, and heating.

c) Proper design to reduce installation and service costs.

d) Best use of naturally favorable factors in design.

2. Competitive conditions require thorough knowledge of design and application.

3. Buyers entitled to good engineering included in cost of job.

B. *Place of manufacturers in the training process*

1. Often required to do the job.

2. Best suited to do it.

C. *Material with which to work*

1. Ideal.
   a) Educational background.
   b) Practical experience.
2. Actual.
   a) Organizations.
      (1) Refrigeration.
      (2) Heating and ventilating.
         (*a*) Larger contractors used to larger types of commercial and industrial jobs.
         (*b*) Smaller contractors used to smaller types of commercial and residential jobs.
      (3) Merchandisers — appliance dealers.

D. *Training process*

1. Ideal.

*Syracuse, N. Y.

a) Service and installation training.
b) Engineering and estimating training.
2. Actual.
a) Practical influences.
(1) Variation to suit individuals and groups.
(2) Compromise with ideal.
b) Agencies for training.
(1) Manufacturers.
(*a*) Schools for large groups.
(*b*) Individual contact by representatives of manufacturers.
(2) Public and privately operated engineering schools.
c) Steps of training.
(1) Desirability of at least limited instruction in fundamentals of thermodynamics and hydraulics.
(2) General methods and application of heating, refrigeration, and air-conditioning equipment.
(3) Application of specific manufacturer's equipment.
(*a*) Peculiarities of application and rating data.
(*b*) Limitations of equipment.
(4) Application to specific jobs.
(5) Follow-up.
(*a*) Up-to-date and regular supply of new and revised design and application data by: (1) manufacturers, (2) technical societies.
(*b*) Regular visits by manufacturer's representatives: (1) criticism of installations; (2) aid on jobs in design or installation stage.
c) Role of outside agencies.
(1) Universities and technical colleges.
(2) Privately operated training schools.
(3) Accessory manufacturers.
(4) Technical societies.
(5) Consulting engineers.
(6) Government agencies.

Conclusions

1. Large share of responsibility for training rests with manufacturer.
2. Training a continual process if industry is to advance and realize its possibilities.

Acetylene Welding

G. F. LARTZ*

UNIT I: METHODS AND PROCEDURES
Learner's Job: Listen and observe
What Learner Should Know:
1. Scope of gas welding
2. Cautions and courtesy
3. Importance of protecting body and eyes
4. Importance of checking equipment
What Learner Will Do:
1. Familiarize self with cautions
2. Familiarize self with courteous procedures
3. Obtain proper clothing

UNIT II. ACETYLENE WELDING EQUIPMENT
Learner's Job: Connect equipment
What Learner Should Know:
1. Safe practices in handling equipment
2. How acetylene gas is made
3. How oxygen gas is made
4. Purpose and construction of regulators
5. Types of torch — low pressure, equal pressure, high pressure — (a) Welding; (*b*) Cutting
6. Tip assemblies
7. Cost of standard equipment items
What Learner Will Do:
1. Fasten and arrange cylinders
2. Connect acetylene regulator
3. Connect oxygen regulator
4. Connect hose to regulators
5. Connect hose to torch

UNIT III. PRESSURE AND CONSUMPTION
Learner's Job: Practice lighting torch to neutral flame
What Learner Should Know:
1. Proper tip-assembly pressures
2. Approximate tip-assembly consumption
3. Chemistry of neutral flame
What Learner Will Do:
1. Open and adjust acetylene regulator
2. Open and adjust oxygen regulator
3. Open acetylene valve on torch
4. Light acetelyne gas
5. Open oxygen valve
6. Adjust for neutral flame
7. Practice until proficient

UNIT IV. WELDING MILD STEEL
Learner's Job: Practice tack, butt, lap, and flange welding on 18- or 20-gauge sheet metal
What Learner Should Know:
1. Blueprint reading — welding symbols
2. Metals and their melting points
3. How to prepare stock for welding
4. Principles of joint design — (*a*) tack weld; (*b*) butt weld; (*c*) lap weld; (*d*) flange weld
5. How to control puddle
6. Importance of weld testing
7. Why filler rods are used
8. Effect of heating and cooling steel
What Learner Will Do:
1. Prepare stock — (*a*) Clean; (*b*) Grind; (*c*) Chip
2. Light torch (See Unit III)
3. Carry puddle — (*a*) without rod; (*b*) with rod
4. Make — (*a*) a tack weld; (*b*) a butt weld; (*c*) a lap weld; (*d*) a flange weld
5. Test each weld
6. Practice until proficient

UNIT V. PIPE WELDING
Learner's Job: Practice welding on 1-in. steel pipe or tubing
What Learner Should Know:
1. Kinds of pipe — (*a*) black steel; (*b*) galvanized steel
2. Safety procedures for this type of welding
3. How metals are identified
What Learner Will Do:
1. Prepare stock — (*a*) grind; (*b*) assemble
2. Rotate weld around pipe
3. Position weld on pipe — (*a*) horizontal; (*b*) vertical
4. Test each weld
5. Practice until proficient

UNIT VI. CAST IRON
Learner's Job: Practice welds on ¼-in. cast iron
What Learner Should Know:
1. Metallurgy of welding cast iron
2. Type of welding rod necessary
3. Why flux is used for cast-iron welding
What Learner Will Do:
1. Prepare stock — (*a*) grind; (*b*) chip; (*c*) clean
2. Fusion weld cast iron

UNIT VII. BRONZE WELDING
Learner's Job: Brace ¼-in. cast-iron steel and brass
What Learner Should Know:
1. Importance of heat control
2. How flux is used for bronze welding
3. How to estimate job costs
What Learner Will Do:
1. Prepare stock
2. Practice bronze welding cast iron until proficient
3. Practice welding steel until proficient
4. Practice welding brass until proficient

UNIT VIII. CUTTING
Learner's Job: Make straight-line cuts in ¼-in. steel plate and cast iron
What Learner Should Know:
1. Principles of oxyacetelyne cutting
2. How machine cutting is done
3. How cast iron is cut
4. Applications
What Learner Will Do:
1. Clean stock
2. Make straight line, square, and bevel cuts in steel plate
3. Cut cast iron
4. Practice until proficient

UNIT IX. WELDING COPPER
Learner's Job: Make butt, weld on copper pipe and flat sheet
What Learner Should Know:
1. Characteristics of copper
2. How flux is used for this type of welding
3. Type of rod
What Learner Will Do:
1. Butt-weld copper sheet
2. Butt-weld copper pipe

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3. Practice until proficient

UNIT X. ALUMINUM

Learner's Job· Make butt and flange welds on ¼-in. aluminum sheets

What Learner Should Know:

1. Characteristics of aluminum
2. Fluxes and rods necessary for successful welds
3. Applications — aircraft

What Learner Will Do:

1. Clean and support job
2. Butt-weld aluminum sheet
3. Flange weld aluminum sheet
4. Butt-weld aluminum tube
5. Practice on each until proficient

Course of Study in Radio Communications

FRANK PETRAGLIA*

The following is a course of study which is used for instruction in the international radiotelegraph code, sending and receiving, on the exploratory level. The course has been designed for three-hour classes, daily, for five weeks. At the completion of this period, pupils have gained a good familiarity with the elements of code communication; a five-words-per-minute receiving and sending speed being established as average passing grade. The more proficient pupils will often achieve a speed of seven words or better.

Follow-up, by means of short-wave club activity, serves to facilitate and guide pupils in preparation for a radio amateur license. Radio amateur activity, which provides the alert pupil with unlimited geographical space to adventure into, results in a wide variety of stimulating educational experiences. In the radio industry, radio amateur experience is regarded as ideal apprenticeship. In fact, after two or three years of amateur operating, the young operator finds himself equipped for applying for the commercial grades of radio-operator licenses.

Figure 1 shows the basic shop equipment. Four code tables, complete with eight operating receiving and sending positions at each table, are across the master-control position. Tables may be cut in or out by the instructor at the switchboard. Also, each table will operate independently so that one pupil may send to the whole table. A vacuum-tube oscillator and loud-speaker are likewise in use, to provide group practice while the use of the separate tables makes individualized instruction possible.

The analysis of the radio operating trade serves as the basis for a course of study designed for more specialized instruction on the vocational or trade-training level, in the terminal year.

Analysis of the Radio Operating Trade

Trade Science

Electrical Units — Why we need units — current flow, ampere, milliampere, microampere — electrical pressure, the volt — conductance, the ohm — relation between units, Ohm's law — voltage drop, fall of potential — electrical power, the watt — electrical conductivity and resistance of various materials — temperature coefficient.

Magnetism — Attraction and repulsion — temporary, permanent magnets — electromagnets — "magnetic field around current-carrying wire — ampere turns — permeability, saturation, hysterisis.

Alternating Currents — Methods of producing a.c. cycles and frequency — instantaneous, maximum, average, and effective values.

Electromagnetic Induction — E.m.f. produced by magnetic field and conductor — value and direction of induced e.m.f. — explanation of principle of electromagnetic induction — mutual induction.

Electrical Circuits — Series circuits, parallel circuits, series-parallel circuits.

The Transformer — Principle of operation — ratio — losses, eddy currents — autotransformer — coupling between transformers —

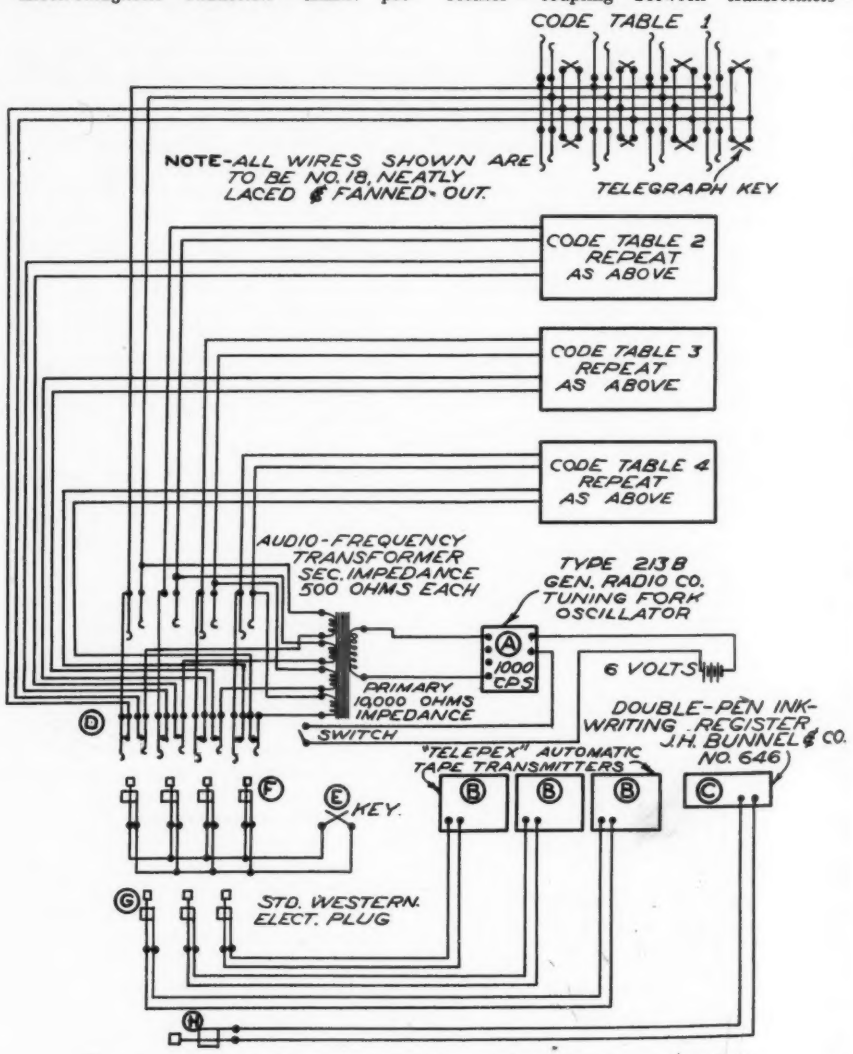


Fig. 1. Diagram of connections from code tables to control desks

*Gompers Vocational High School, Bronx, N. Y.

why transformer cores are laminated — why transformers will not work on d.c.

Inductance — The principle of self-inductance — the henry — inductive, noninductive windings — inductors in series and parallel — inductive coupling — variation of inductances — why core saturation reduces inductance — use of air-gap in ironcore inductances — use of twisted pair wires to reduce mutual inductance effects.

Capacitance — Principle of operation of condensers — dielectrics — condenser losses — voltage rating and breakdown — in series and parallel — types of radio condensers — inductive and noninductive condensers — electrolytic condensers — capacity coupling.

A.c. Circuits — Circuits containing resistance, inductance and capacity — capacitive and inductive reactance — impedance — Ohm's Law of a.c. — Resonance — wave length and frequency — low- and high-pass filters.

Radio Transmission — Long and short waves — carrier wave and modulations — oscillating circuits — conditions for oscillation — effect of coupling — power output of an oscillator tube — master oscillator systems — keying a transmitter.

The Detector — Crystal, diode, and grid-leak detection — linear and power detectors — square law detector — the regenerative type.

Vacuum Tubes — Construction — purpose of filament, plate and grid — the tube as an amplifier — general purpose and power tubes — explain amplification factor, plate resistance and transconductance — measurement of vacuum-tube constants — variable Mu tubes — effect of suppressor grid — multi-element tubes — how to read and use tube characteristics charts.

Radio Testing Instruments — External effects of an electric current — shunts and multipliers — a.c. instruments — moving iron and dynamometer instruments — wheatstone bridge explain ohms per volt.

Receiving Systems — The T.R.F. set — the regenerative receiver and amplification — the superheterodyne — calibrating a receiver with a wavemeter — magnetic phenomena in connection with functioning of headphones — trouble shooting the receiver — CW and ICW reception — the radio compass.

Transmitting Systems — Conditions for oscillation — undamped and continuous oscillations — efficiency of an oscillator — the arc, spark, and tube transmitters — care and maintenance — trouble shooting the transmitter.

Antenna Systems — Radiation resistance — the radiation field — types of antennas — inductance and capacity of antennas — wave length of antenna — leading an antenna — decreasing wave length — fading — static.

Rectifier and Power Supply Apparatus — Fundamental rectifier circuit — kinds of rectifiers — power supply for arc, spark, and tube — voltage divider systems — filter systems — care and maintenance.

Trade Math

All, and order of, basic operations involving integers, fractions, mixed numbers, and decimals.

Changing fractions to decimals and vice versa. Decimals and powers of ten.

Square root.

Solution of simple equations of first and second degree. Variation, direct, and inverse proportion, constant of variation.

Measurement: Linear measurement, use of rulers. Meter reading, calculations of value per division for meter scales, estimation of final figure in a meter reading.

Prefixes used in calculations:

Prefix	*Abbr.*	*Meaning*
deci, centi	d, c	one tenth, hundredth
mil, milli	m	one thousandth
micro		one millionth
micro-micro		one millionth of a millionth
kilo	k	1000 times
mega	M	1,000,000 times

Use of Tables: To determine: Wire size needed to carry given current, to have given resistance per unit of length, or occupy a given winding space. Frequency in terms of wave length and vice versa and inductance of coil to resonate with capacity at set frequency.

Use of Graphs and Curves: To determine: Correct operating conditions for any tube, transmitting and receiving. Frequency response range of radio, amplifier, speaker, etc.

Use of Formulas: To determine: (1) Calculate resistance and wattage needed for a given purpose. (2) Find proper capacity to by-pass resistor at given frequency. (3) Calculate inductance for choke to provide impedance for a circuit. (4) Calculate resistance values for shunts and multipliers in meters. (5) Determine peak voltage of condenser to withstand a given applied r.m.s. voltage. (6) Phase angle in alternating current circuits. (7) Power factor in a.c. circuit. (8) Resistance, capacitance, inductance in series and parallel circuits.

Commonly Used Formulas:

For all of the foregoing formulas:

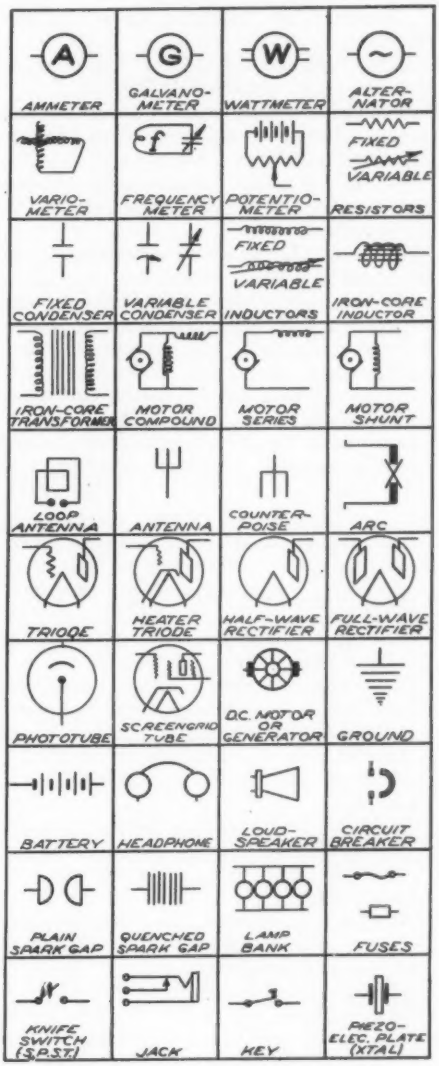
C = capacity in farads

OHM'S LAW	$I=\frac{E}{R};R=\frac{E}{I};E=IR$
POWER FORMULA	$W=EI=I^2R$
RESISTANCES IN PARALLEL	$R=\frac{1}{1/R_1+1/R_2+1/R_3+\text{etc.}}$
RESISTANCES IN SERIES	$R=R_1+R_2+R_3+\text{etc.}$
CONDENSERS IN SERIES	$C=\frac{1}{1/C_1+1/C_2+1/C_3+\text{etc.}}$
CONDENSERS IN PARALLEL	$C=C_1+C_2+C_3+\text{etc.}$
INDUCTIVE REACTANCE	$X_L=2\pi FL$
CAPACITIVE REACTANCE	$X_C=\frac{1}{2\pi FC}$
IMPEDANCE	$Z=\sqrt{R_2+(X_L-X_C)^2}$
RESONANCE FREQUENCY	$F=\frac{1}{2\pi\sqrt{LC}}$
FREQUENCY AND WAVELENGTH	$K_C=\frac{300,000}{\text{METERS}}$

Commonly used formulas

E = pressure in volts
I = current in amperes
R = resistance in ohms
L = inductance in henries
X = reactance in ohms
X = inductive reactance
X = capacitive reactance
Z = impedance in ohms
π = 3.1416 (22/7)

Trade Drawing



Symbols used on radio diagrams

Notations and Abbreviations used on Drawings:

ant. — antenna
a–f — audio frequency (adj.)
f — cycles per second
i–f — intermediate frequency
kc — kilocycle
4–f — radio frequency (adj.)
mmfd — micro-microfarad
db — decibel
gnd — ground
h — henry
w — ohms
Ω — emgohms

h — microhenry
mfd — microfarad

Practical Applications of Symbols:

Draw schematic diagrams of the following:

Fundamental Hartley, Colpitts, and Tuned-Plate Tuned-Grid oscillating systems.

Full-wave rectifying circuit; half-wave circuit.

Diagram of spark transmitter complete with auxiliary power equipment and automatic starter.

Diagram of master-oscillator power amplifier.

Simple regenerative receiver with detector and two stages of audio-amplification.

Complete modern marine radio installation including transmitter, power-supply apparatus, and commercial receiver.

Layout Drawings: Make rough layout sketches for all devices mentioned in the foregoing.

Lettering: Letter all above drawings, using notations and abbreviations.

Reading and Interpreting Drawings and Diagrams: Referring to a diagram, determine type of circuit used. Trace filament, plate and grid circuits. Determine number and type of tubes used. Determine number and type of amplifying stages. Make a block diagram illustrating action of transmitter and receiver showing changes in frequency, amplitude, and wave form.

Trade Terms

Alternating current, amplification factor, amplifier, anode, antenna, audio frequency, attenuation, autodyne, aerial, ammeter, armature.

Band-pass filter, beat frequency, by-pass condenser, band spread, bakelite.

Capacitive coupling, carrier frequency, carrier wave, cathode, choke coil, condenser, cycle, conductor, control grid, capacity.

Decibel, detector, diode, direct coupling.

Electron, electron emission, electron tube, electrode.

Filament, filter, frequency, full-wave rectifier, fundamental frequency, feed-back.

Grid-bias, grid leak, grid-plate capacity, ground wire.

Harmonic, heterodyne, half-wave rectifier.

Inductance, interelectrode, impedance, inductive reactance, insulation.

Kilocycle.

Lead-in, lamination.

Megacycle, microphone, modulation, Mu of a tube.

Oscillator, ohmmeter.

Pentode, plate of a tube, push pull, point to point tests, power output.

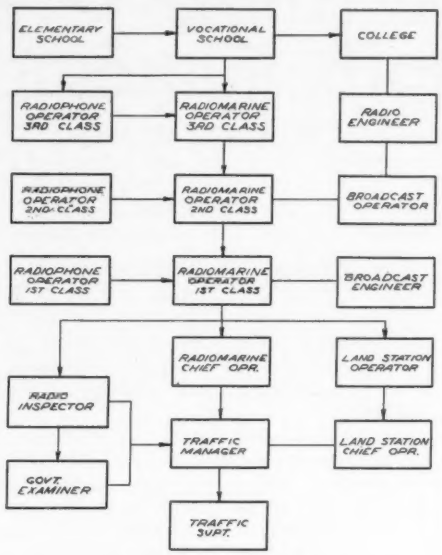
Radio channel, radio frequency, regeneration, resonance.

Secondary emission, shielding, side bands, static, stopping condenser.

Thermionic emission, thermocouple, transmission unit, tuned circuit, transmission line.

Vacuum tube, voltage, voltmeter, voltage regulation.

Wave length, Wheatstone bridge, wattage dissipation, wavemeter.



Opportunity chart

The Cable-Count System

The cable-count system of counting the check is used for radiograms. This system provides that all words in the address, text, and signature must be counted and charged for. Messages are divided into two classes: plain language, and code language.

Plain-language messages must be written entirely in plain language. Words are counted on the basis of 15 characters to the word. Any fractional part of 15 characters is also counted as one word. Numbers up to five in a group would be counted as one word, over five as two words.

Examples:

Gymnasium, 1 word	7,583..1 word
Intellectualities, 2 words	37,463..1 word
Unconstitutional, 2 words	987,534..2 words
Constantinople, 1 word	

Code-language is made up of pronounceable words of no direct meaning not to exceed ten characters in length. If a code word exceeds ten characters in length it is counted as two words, and this is noted in the check. Words in which the meaning has been concealed by reversing the order of the letters or syllables will not be accepted as code words.

Examples:

BEYINXJEHI .....1 word
X-ray .....2 words
XQNOW .....not accepted

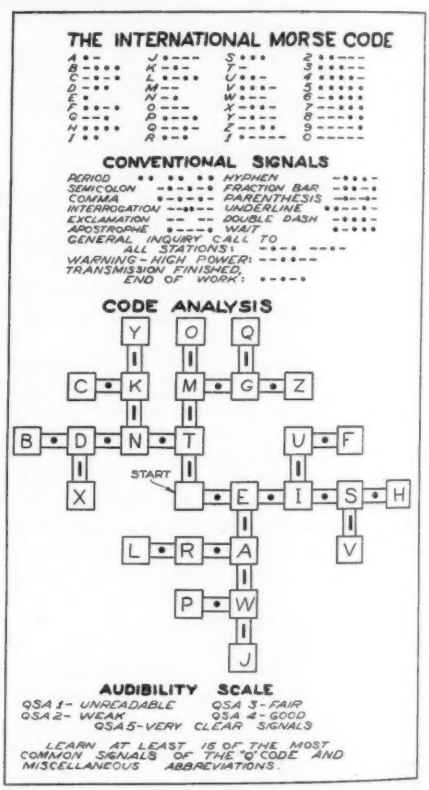
When a message is written in mixed language, a careful checkup under the following rules must be made:

Code and Plain Language. Maximum length of word chargeable is ten characters. Hyphenated or compound words are counted as so many separate words.

Names of places, such as New York, New London, or Frankfurt am Main are counted as one word in the address and two words in the text.

The check should be noted in the first part of the preamble of the radiogram.

Delivery rates are included in the radio station handbook.



Course of Study in Radio Communications

Unit 1. Jobs and Operations	*Related Information*
1. To learn the International Radiotelegraph Code.	Memorizing sound. Difference between *dit* and *dah*.
a) Alphabet drill in *e-i-s-h, t-m-o, a-n-v, n-d-b* groups.	Copying entered into copybooks.
b) Copying practice.	
2. *a*) Drill in remainder of alphabet.	How to avoid confusion in similarity of letters.
b) Arrange receiving and sending systems of code groupings in copybook.	How both groupings are used.
3. *a*) Numerals	Five signals in each numeral.
b) Each pupil recites alphabet from memory.	Recite alphabet as sound.
c) Alphabet receiving practice.	How to check copy. Notation of errors.

Jobs and Operations	*Related Information*
4. *a*) Code analysis.	Draw diagram.
b) The telegraph key.	Details of operating position.
c) Earphones.	Care in handling.
d) Receiving practice.	Checking.
5. *a*) Complete pupil recitation of alphabet.	Emphasize need for thinking of Morse International characters aurally.
b) Receiving test in alphabet.	Send 100 letters and numbers at 3 words per minute.
c) Pupils send on loud-speaker from teacher's operating desk.	*Dits* short. *Dahs* long.
d) Assign call letters to pupils.	Explain commercial and amateur calls.
e) Pupils instructed in how to keep station log and make up letter and numeral groups for practice.	F.C.C. regulations regarding logs. Practice groups to be used in sending practice.
Unit 2	
6. To attain accuracy in receiving and sending code characters. *a*) Receiving plain-language word groups.	Avoid lettering in copying.
b) Sending plain-language word groups.	Observe four-second spacing. Keep receiving scores.
7. *a*) Receiving word groups continued.	Need for attentive listening. Neatness and legibility in copy.
b) Sending word groups.	Timing, spacing, and rhythm.
8. *a*) Receiving short sentences.	Checking. Note "weak" letters.
b) Sending short sentences.	Pupils send on loud-speaker and to themselves on tables.
9. *a*) Receiving and sending continued as above.	Apply 3-second spacing between words.
b) Copy telegraph-key blueprint.	Construction details.
10. *a*) Sending and receiving tests.	Pupils check each other's receiving copy. Sending test on loud-speaker for check of individual proficiency.
Unit 3	
11. *a*) Receiving. Pupils copy various long texts.	Increase speed to five words per minute. How to avoid "jamming" in copying.
b) Sending. Pupils send from assigned texts with effort at increasing speed.	Attention to spacing and balanced code characters.
12. *a*) Continuation of previous drills, receiving, and sending.	The four parts of the radiogram. Pupils compose 15-word radiogram.
b) The Radiogram.	
13. *a*) Receiving. Send radiograms to pupils.	Observe special method of procedure for radiograms.
14. *a*) Sending. Pupils send radiograms to each other.	Checking word count. Asking for repeats.
15. *a*) Weekly code test.	Enter results in station logs.
Unit 4. To Increase Receiving and Sending Speeds, and Extend Familiarity With Operating Procedures	
16. *a*) Receiving and sending radiograms.	Giving acknowledgment of receipt.
b) Copy NAA U. S. Time Signals.	Explain WX, TX, QTE reports.
17. *a*) Speed exercises.	News items for text.
b) Audio oscillator.	Diagram and construction details.
18. *a*) Receiving. News continued.	Draw diagram of automatic sender.
b) Sending. News items.	Discuss PX.
19. *a*) Discuss beginner's short-wave transmitter.	Construction details.
20. *a*) Weekly receiving and transmitting tests.	Four and five and six words per minute.
Unit 5. Summary and Review	
21. *a*) Practice in calling and answering procedure.	FCC regulations.
b) Alphabetical speed drills.	
22. *a*) Receiving and sending emergency communications.	TTT, SOS, XXX.
b) Direction finder.	Demonstrate shop equipment.
23. *a*) Sending CQ, QST.	Government regulations.
b) Phone calls.	Practice calling on shop microphone-amplifier.
24. *a*) Tuning the receiver.	Regeneration, oscillation, "zero beat."
b) Receiving and sending.	Radiograms, news, texts.
25. *a*) Receiving. Four- to seven-word-per-minute tests.	Average all test marks.
b) Sending tests.	Pupils send from loud-speaker.
c) Admission to radio club.	Passing grade required — five-words-per-minute receiving and sending.

Course of Study in Sheet-Metal Work

HERBERT K. IVERSON*

A course of study, to be effective, progressive, and functional, must adhere to certain definite criteria in order that the material covered may be presented in an orderly and progressive manner. An adequate course of study will provide this, and if faithfully pursued, the desired ends will be obtained. An understanding of the fundamentals of the material to be presented is, of course, necessary, but in addition to this, some attention to ideals, appreciations, and attitudes must be considered.

We are concerned here with industrial arts, a part of the educational procedure which attempts to train pupils in the techniques peculiar to the subject matter in this field, and to develop concomitant learnings; these latter are often more important than the skills which they accompany. In a predominantly industrial nation it seems that industrially minded citizens should be a by-product of the educational mill through which they have come; therefore, aims in industrial arts should consider this fact. Boys and girls of school age no longer have the opportunity to participate in industrial pursuits until they are older. This can partially be overcome in the school, but more precisely only in the industrial-arts program, and here only if the subject-field aims allow it.

We are concerned here specifically with a course in sheet-metal work which by itself is one of the fields in the curriculum area of metalwork, and since this is a part of the general school program, it precludes vocational training. A measure, however, of occupational training will be received by all those enrolling in the course. Adequate provision should be made to enhance the opportunity for learning by providing sufficient non-manipulative material of a kind, technically or otherwise related, to the specific field in which we are interested. Operations must be

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learned which in turn provide for the development of skills in the use of the tools peculiar to this vocation. An appreciation of good workmanship and materials will grow out of the activities accompanying the learning of the basic operations. While these operations are important, considerable time should be devoted to the appreciations, ideals, and attitudes that are to be developed, and which in the final analysis are equally important. An examination of the aims will disclose that proper emphasis has been placed on this phase of industrial-arts teaching. A teacher should be urged to develop his own subject aims and to determine their scope because he is cognizant of the problems of the area in which he lives. Local needs, equipment, administrative desires, shop size, etc., are all things with which he is familiar and on which he will be best informed. A standardized course of study is not desirable for these reasons, even though it is agreed upon that basic operations are the same no matter what or where the locality. It is the portion of the course that has to do with the concomitant learnings that cannot be standardized and can only be developed to the extent of the locality in which the material is to be studied.

Subject Aims

1. To give the pupil practice in the use of sheet-metal worker's equipment and materials.
2. To inform the pupil of occupational opportunities in the sheet-metal trade.
3. To increase the pupil's knowledge of information related to the sheet-metal trade.
4. To develop an appreciation of sheet-metal products.
5. To acquaint the pupil with labor laws, apprenticeship programs, and other possibilities in the sheet-metal trade.
6. To develop an appreciation of skillful work and honest labor.

Content is that part of the course of study which is presented to the pupil and which he must master with whatever proficiency he is capable. Sufficient material must be included to preclude the completion of all the work by any one student, thus providing for the bright individual as well as for the dull. It is sometimes well to include operations too difficult for any student to perform but within the capabilities of the instructor. A difficult operation skillfully performed by the instructor is a good motivating device that will develop a purposeful attitude on the part of the pupil. Much enriching material should be included of a nonmanipulative character. The content considered in this course of study has been developed for use in the high school, both day and evening, the latter in this particular case being predominantly defense training.

Figure 1 is an analysis chart based on units of instruction on which is indicated the entire course content. On the left are listed the operations, and across the top are shown type jobs which are supplemented as shown on the chart. The related information is both technical and nontechnical and is merely a suggestion. The teacher will be able, and is urged to add to this list, as well as present other jobs or information which incorporate the learning units. Included under content are listed the supplies and equipment needed to conduct the course. The extensiveness of the equipment is dependent upon shop space, numbers of pupils, money available, and community needs. The list included here is sufficient for a class of 25 high school students, and it also meets the needs for evening school students. The equipment and supplies, as itemized, have been found to be adequate. In addition to those listed, a cornice brake and a squaring shears are necessary.

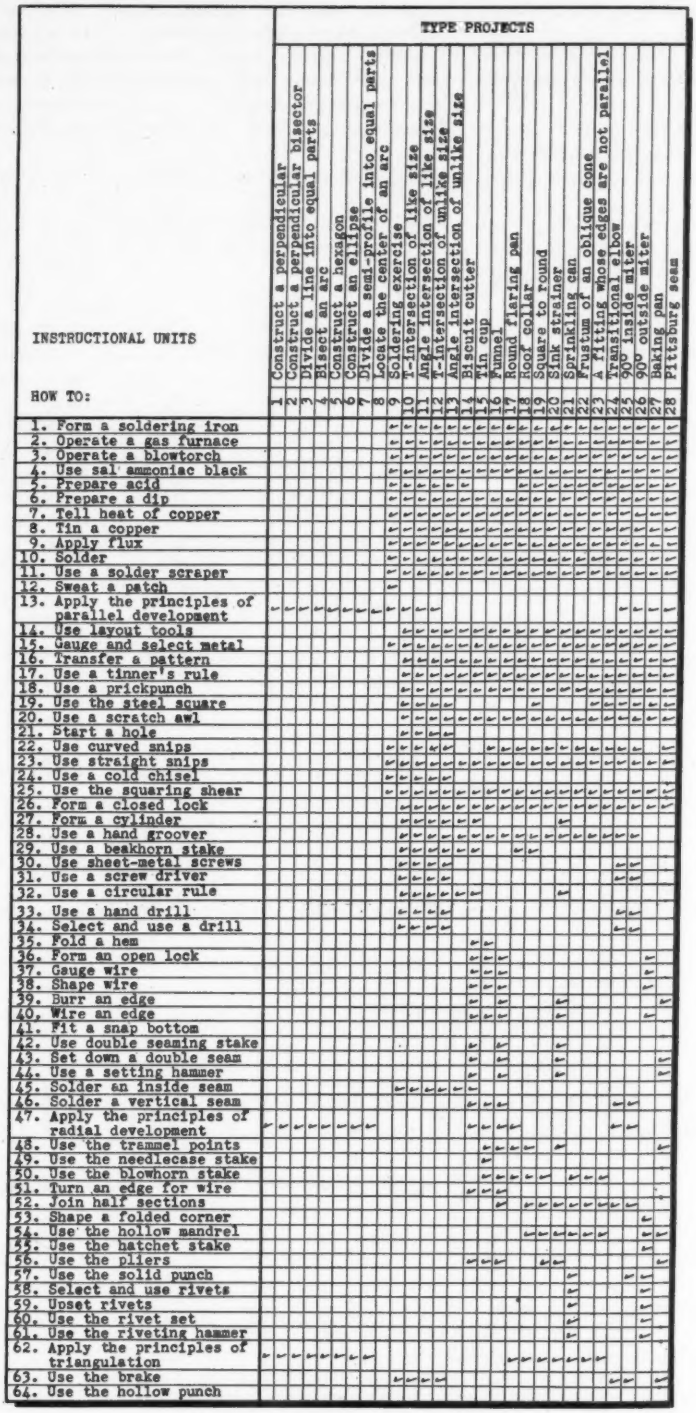

TYPE PROJECTS
INSTRUCTIONAL UNITS
HOW TO:
1 Construct a perpendicular
2 Construct a perpendicular bisector
3 Divide a line into equal parts
4 Bisect an arc
5 Construct a hexagon
6 Construct an ellipse
7 Divide a semi-profile into equal parts
8 Locate the center of an arc
9 Soldering exercise
10 T-intersection of like size
11 Angle intersection of like size
12 T-intersection of unlike size
13 Angle intersection of unlike size
14 Biscuit cutter
15 Pin cup
16 Funnel
17 Round flaring pan
18 Hood collar
19 Square to round
20 Sink strainer
21 Sprinkling can
22 Frustum of an oblique cone
23 A fitting whose edges are not parallel
24 Transitional elbow
25 90° inside miter
26 90° outside miter
27 Baking pan
28 Pittsburg seam
1. Form a soldering iron
2. Operate a gas furnace
3. Operate a blowtorch
4. Use sal ammoniac black
5. Prepare acid
6. Prepare a dip
7. Tell heat of copper
8. Tin a copper
9. Apply flux
10. Solder
11. Use a solder scraper
12. Sweat a patch
13. Apply the principles of parallel development
14. Use layout tools
15. Gauge and select metal
16. Transfer a pattern
17. Use a tinner's rule
18. Use a prickpunch
19. Use the steel square
20. Use a scratch awl
21. Start a hole
22. Use curved snips
23. Use straight snips
24. Use a cold chisel
25. Use the squaring shear
26. Form a closed lock
27. Form a cylinder
28. Use a hand groover
29. Use a beakhorn stake
30. Use sheet-metal screws
31. Use a screw driver
32. Use a circular rule
33. Use a hand drill
34. Select and use a drill
35. Fold a hem
36. Form an open lock
37. Gauge wire
38. Shape wire
39. Burr an edge
40. Wire an edge
41. Fit a snap bottom
42. Use double seaming stake
43. Set down a double seam
44. Use a setting hammer
45. Solder an inside seam
46. Solder a vertical seam
47. Apply the principles of radial development
48. Use the trammel points
49. Use the needlecase stake
50. Use the blowhorn stake
51. Turn an edge for wire
52. Join half sections
53. Shape a folded corner
54. Use the hollow mandrel
55. Use the hatchet stake
56. Use the pliers
57. Use the solid punch
58. Select and use rivets
59. Upset rivets
60. Use the rivet set
61. Use the riveting hammer
62. Apply the principles of triangulation
63. Use the brake
64. Use the hollow punch

Fig. 1. Analysis of sheet-metal operations

Method

Method is defined as the means used to present the content to the pupil so that he may learn the material most efficiently and effectively. It is the way that the pupil is shown how to perform the operation, how to seek related information, in short, how to make it possible for the pupil to attain the

desired outcomes after being exposed to the material of the course.

We will consider the group method, the individual method, the instruction-sheet method, the demonstration method, and the committee method. The group method is that one where the entire class is brought together for a discussion of either manipulative or nonmanipulative material. It is used most successfully at the beginning of the school year when all the pupils are just starting. It is also useful whenever problems arise during the year that are of interest to all the pupils. Related information is best presented in this manner, which is true also whenever any extra material is brought in by the pupils. Group discussions may well be held once a week for an hour's duration, providing adequate classroom facilities are available, such as blackboard space and chairs. Other group discussions of an informal nature may be impromptu and should not last more than 10 or 15 minutes. Group discussions are teacher led and directed; however, the responsibility of the material to be covered is on the shoulders of the pupils. During group discussions, questions of interest to the entire class should be discussed; however, occasionally some of the time may be devoted to other material not immediately useful to all. The individual method is best used as a follow-up for the group discussion. The dull individual is most likely in need of this kind of aid; however, others in the class should be observed to see if they are in need of help. Individual instruction may be either manipulative or nonmanipulative depending upon the need of the student. Individual instruction should be kept to a minimum, otherwise the pupil may depend upon the instructor rather than upon himself. This instruction is valuable, and if properly given, is likely to be remembered by the student better than when the information is given any other way. The danger, however, is that unless the teacher is careful he is liable to supplant student effort which is not a desirable situation.

The instruction-sheet method utilizes instruction sheets, operation sheets, and job sheets as an aid to the pupil, to help him solve problems that have been discussed in the group lecture. These sheets do not take the place of the teacher but merely help the pupil refresh his memory. They are useful to the bright pupil who advances beyond the work of the class, and who needs additional instruction in order to keep on going. Unless, however, the sheets are well constructed, they may be worse than no information at all. These sheets may well be teacher made, and in most cases this is desirable, as the information contained in them will fit the course of study that the teacher has developed. Considerable work is involved, and some method of filing must be devised for storage. Illustrations are important, and considerable effort may well be expended in this direction. Written material in the sheets should be kept at a minimum, and that used should be well within the capacity of the pupil.

The demonstration method is used when manipulative material is to be presented to the class. This is usually a group method; however, much individual instruction will be found necessary to clear up points not clearly understood during the group discussion. When demonstrating, the teacher should be sure that all the equipment and materials he will use are at hand, and it is often advisable to go over the demonstration before it is presented. Only the best work that the teacher is capable of performing should go into the demonstration. At this time it is sometimes well to demonstrate some operation beyond the capabilities of the pupils in the class. All tools should be in the best of condition as should also be the teacher's demonstration bench. The demonstration should be conducted slowly and all steps clearly explained, with time allowed for questions. The demonstration may be held at any time that the need arises, and this is a matter that must be decided in the shop. After the first demonstration, it is virtually impossible to present subsequent ones at a time when the entire class is ready for them. This is where the instruction sheet is of real value. Obviously all of these methods are not to be used only in specific instances, but they are interrelated and all are

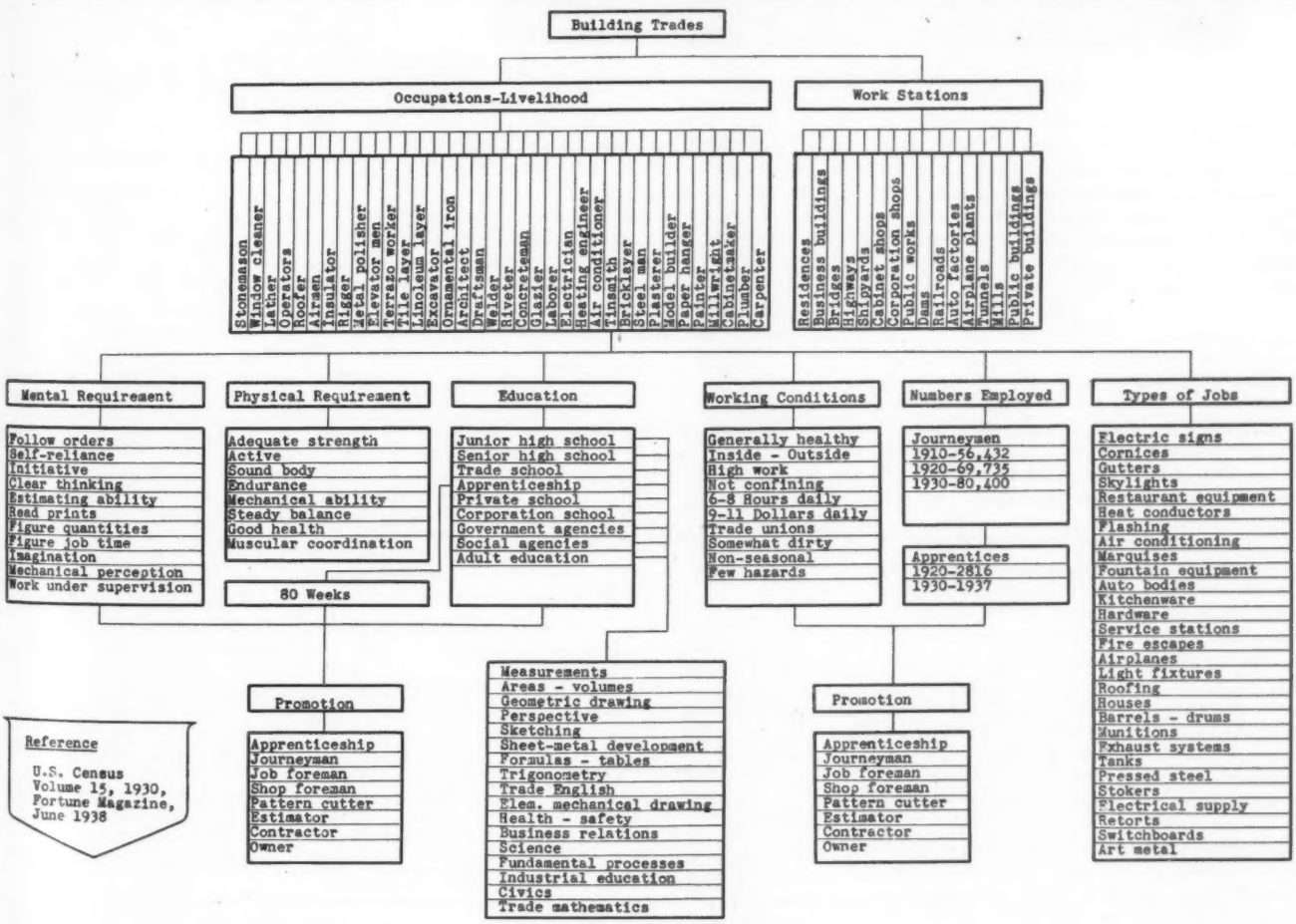
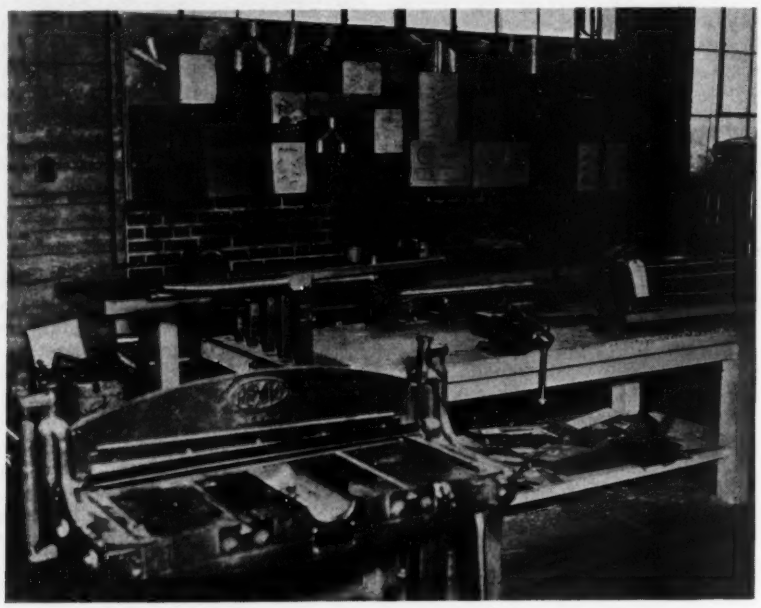


Fig. 2. Occupations chart

used whenever necessary to attain the desired end.

The committee method is that method which divides the boys into groups, each one of which is interested in some particular phase of the course. It is teacher guided, but boy instigated and developed. Its greatest value is its integrating influence in that during the investigation all manner of sources are searched for the desired information. It probably is more concerned with nonmanipulative material than with any other; however, the information uncovered may well be incorporated in the final results. Each committee should, in most cases, prepare written material that will be presented to the class at the end of the problem.



Sheet-metal shop

Tests

In order to measure the work of the shop student reliably, for the purpose of awarding marks, two kinds of tests are required. Generally, these are called performance tests for the measuring of manipulative techniques, and the ordinary pencil-and-paper type which are used to measure the nonmanipulative portion of the subject.

The pencil-and-paper type may be essay or objective tests. In many cases these tests may be teacher made. This type of test is best used to ascertain the amount of related information the pupil has retained, and they are useful for diagnosing pupil difficulty or teacher deficiency. Tests should not be made up of only one kind of question, but rather of several kinds, because of pupil individual differences. Not all pupils can do successfully with one kind of test question; therefore, it is necessary that several kinds be employed. Pencil-and-paper tests may be given at any time that seems advisable, and they may be either long or short, depending on the information sought. Tests should be used over and over, meanwhile eliminating those items in the test that do not seem to fit. Correlation coefficients may be developed and when once established to the satisfaction of the teacher, the test may be considered standardized for the particular situation.

Performance tests, while not new, have generally not been used because the reliability has been low. They are, however, useful for the measuring of manipulative dexterity and are, therefore, better than teacher judgment. They are not primarily speed tests, but are rather used to measure quality or accuracy. It is obviously impossible to measure manipulation by pencil-and-paper techniques as this would not lead to valid or reliable marks. Since marks are important and since they do indicate a pupil's success in future educational endeavors, it is evident that considerable attention should be devoted to this phase of industrial-arts teaching.

Tools and Equipment

6 Awls, scratch, No. 7
1 Blowpipe, No. 3
2 Calipers, outside, solid nut, 6 in.
6 Chisels, cold, ½ in.
6 Chisels, cold, ¾ in.
6 Dividers, wing, 8 in.
1 Drill, hand
1 Figures, steel, 9 in set, 3/16 in.
1 Gauge, drill and tap
1 Gauge, sheet and plate, U.S.S.
1 Gauge, American standard wire
1 Hammer, machinist's ball-peen, 7 oz.
2 Hammers, machinist's ball-peen, 13 oz.
4 Hammers, riveting, 12 oz.
1 Letters, set of 28, 3/16 in.
1 Nippers, cutting, 12 in.
2 Nippers, cutting, 7 in.
6 Pliers, 6 in.
3 Punches, center, size D
4 Rivet sets and headers, for 10- and 12-oz. iron rivets or No. 15 copper rivets
8 Rules, 2 ft., steel
2 Saw frames, hack, adjustable
1 Scales, family, weigh 24 lb. by oz.
2 Screw drivers, 6-in. blade
2 Screw drivers, 8-in. blade
1 Screw driver, 12-in. blade
3 Snips, circular blade
10 Snips, straight blade
6 Soldering coppers, 2 lb. per pair
1 Soldering copper, 1 lb. per pair
1 Soldering copper, handled, 3 lb. per pair
3 Soldering furnaces
5 Squares, framing, 24 by 2-in. body, 18 by 1½ tongue
2 Vises, machinist's, 4-in. jaw, solid base
1 Wrench, 8 in.
1 Bar folder, adjustable
1 Turning machine, with cripping and beading rolls
1 Wiring machine
1 Slip forming roll, 36 in.
1 Buffalo small burning machine
1 Double seaming stake
1 Beakhorn stake
1 Blowhorn stake
1 Hollow mandrel stake
1 Needlecase stake
1 Hatchet stake
1 Punch, hollow, ⅜ in.
1 Punch, hollow, ½ in.
1 Punch, hollow, ¼ in.
12 Punches, prick
2 Punches, solid, ⅛ in.
2 Punches, solid, 3/16 in.
2 Punches, solid, tool steel, hardened ¼ in.
6 Mallets, 2½-in. face
2 Rules, circumference, 36 in.
2 Tools, grooving, ⅜ in.

Hardware Equipment

3 Tools, grooving, ¼ in.
3 Tools, grooving, 3/16 in.
4 Hammers, setting, 1 lb.
2 Acid cups
12 Acid brushes
1 Dipping solution jar
1 Bench plate, stationary, 30 by 8 in.
20 Boards, drawing, 22 by 30 in.
20 T squares, 30 in.

Hardware Supplies

12 Each, drills, twist, ⅛ in., 5/32 in., and 3/16 in., ¼ in., 9/32 in., 5/16 in.
3 Each, drills, twist, ⅜ in., 7/16 in., ½ in.
3 File cards and brushes
12 Files, flat bastard, 10 in.
12 Files, flat second cut, 10 in.
12 Files, flat smooth, 10 in.
12 Files, half-round smooth, 8 in.
12 Files, half-round smooth, 10 in.
12 Files, square smooth, 8 in.
12 Files, round smooth, 8 in.
24 File handles, soft wood, iron ferrules
2 Gross, each Hex. nuts, N.F., ¼, 5/16, and ⅜ in.
2 Gross, each Hex. nuts, N.C., ¼, 5/16, and ⅜ in.
25 Pounds rags, wipers, No. 20, white
1 Pound rivets, copper, ⅛ by ⅜ in., r.h.
1 Pound rivets, iron, ⅛ by ⅜ in., r.h.
2 Pounds rivets, iron, ⅛ by ⅝ in., r.h.
2 Pounds rivets, iron, 3/16 by ½ in., r.h.
1 M rivets, tinner's tinned, 10 oz.
1 M rivets, tinner's tinned, 2 lb.
1 M rivets, tinner's tinned, 1 lb.
1 M rivets, tinner's tinned, 12 oz.
5 Pounds rosin, lump
5 Pounds, sal ammoniac, 1-lb. cakes
4 Doz. hand hack-saw blades, 10 in., 24 teeth
4 Gross each, r.h., brass machine screws, 6-32–½ in., 6–32–¾ in.
50 Pounds, strip solder, half and half
2 Pounds soldering paste, "Nokorode," 1-lb. cans
5 Pounds soldering salts
1 Bundle, black sheet steel, 20-gauge, 30 by 96 in.

2 Bundles, black sheet steel, 26-gauge, 30 by 96 in.
1 Bundle, galvanized sheet steel, 22-gauge, 20 by 96 in.
2 Bundles, galvanized sheet steel, 26-gauge, 30 by 96 in.
2 Bundles, galvanized sheet steel, 28-gauge, 30 by 96 in.
1 Box, charcoal tin plate, 1C, 20 by 28 in.
1 Box, charcoal tin plate. 1X, 20 by 28 in.
25 Pounds, galvanized iron wire, 12-gauge
25 Pounds, galvanized iron wire, 16-gauge
5 Pounds hydrochloric acid
5 Pounds zinc scrap
2 Gross each, Parker Kalon r.h. sheet-metal screws, 6 by ⅜ in., 8 by ½ in.

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Supplementary Projects

1. Connect a pipe to a flat surface by means of a bead.
2. Attach a flange by means of a dovetail.
3. Tangent T intersection
4. Tangent angle intersection
5. Card holder
6. Soap tray
7. Square or round scoop
8. Birdhouse
9. Fern box
10. Kitchen stool
11. Pail
12. Chimney cap
13. Gutter
14. Garage drip pan
15. Cookie sheet
16. Sink strainer
17. Liquid or dry measure
18. Flower holder
19. Dustpan
20. Elbows
21. Register box
22. Blower fittings
23. Toolbox
24. Sugar or flour-bin linings
25. Matchbox holder
26. Mudguard shields

Related Information*

1. Shop procedure
2. How to read a drawing
3. How to make a bill of material
4. How to plan a procedure
5. Kinds of fluxes and the uses of each
6. Names of tools, equipment, and material
7. How to care for tools and equipment
8. Standard sheet-metal and wire gauges
9. Methods of manufacturing and distributing tin plate and galvanized iron
10. Commercial sizes of tin plate and galvanized iron
11. Sources, uses, and characteristics of sheet metal
12. Kinds and sizes of sheet-metal tools and supplies
13. Kinds and sizes of rivets, and other fastening devices
14. Specifications covering the manufacturing of sheet metal
15. Occupational information
16. The common uses of sheet metal
17. Changing requirements of the sheet-metal industries
18. Sheet-metal mathematics, science, etc.
19. Personality requirements of the sheet-metal worker
20. Working conditions, wages, hazards, etc.
21. Opportunities, and requirements in the sheet-metal trades. See Figure 2

*Related information is closely related to the progress of the manipulative portion of the course and should be presented whenever it is timely.

First Year Hand Composition

LEONARD E. SCHMIDT*

Getting organized is perhaps the greatest difficulty that faces a teacher when he first steps into the school system.

The following has been prepared with the hope that it will help others solve the problem of getting started in the school print shop.

There is, first of all, a simple outline of a course in hand composition that is used in many of the New York schools. There also is a progress chart for the wall which will stimulate interest, and a report card that combines several useful features. Then there are two instruction sheets which may be used as samples for others which the printing instructor may want to prepare.

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The Course Outline

In order to master the art of setting type, it is necessary to understand and be able to do several fundamental operations. All jobs use one or more of these operations. Therefore, it is important that the student master them. With the exception of the first three lessons, which introduce the boy to the shop, the case and the tools used, this course attempts to perfect the student in these all-important skills. By the time he completes the course he should be able to set almost any job given to him.

The course consists of 48 jobs.

A1. Introduction to the layout of the shop
A2. Learning the California job case
A3. The compositor's tools
A4. Setting words and lines
A5. Setting lines of type
A6. Setting two paragraphs of type
A7. Setting centered lines
A8. Spacing and justification
A9. Proofreading
A10. Resetting a job to a narrow measure
A11. Review of Group A
C1. Introduction to advanced straight matter
C2. Hanging indention
C3. Regular paragraph indention
C4. Diagonal indention
C5. Simple title page
C6. Squared indention
C7. Table of contents
C8. Half diamond or inverted pyramid indention

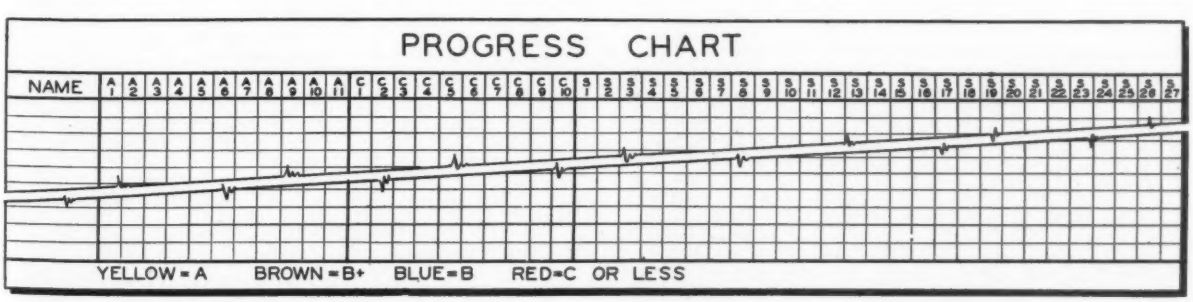


Fig. 1

C9. Setting simple advertisement
C10. General review of indentions

The other 27 jobs are revisions which have the student change the style of copy. For example, from 25 picas regular indention to 20 picas hanging indention. For the more advanced type of student, a few jobs of the cut-in or run-around type may be used.

These revision jobs give the instructor an opportunity to teach the student trade information by having him set copy, about the manufacture of ink, the different types of presses, and the like.

Progress Chart

Since there are 48 jobs to be set, it is a simple matter to draw up a progress chart that will show at a glance where each boy in the class stands in the number of jobs done. Figure 1 has been found to answer very well. Different color crayons should be used to mark the jobs. This will make the poor marks stand out among the good ones, and stimulate the student to keep them down to a minimum. The boys take a great interest in the chart, and visitors always look it over.

Report Card

There are several things a teacher should know about his students besides their conduct and work marks. The card illustrated in Figure 2 shows some of these things. Notice that there is a space provided for each of the

LINCOLN HALL PRINT SHOP

Name ..... Group .....
Home Address .....
Last School attended .....
Parent's or Guardian's Name .....
Entered Shop ..... Left Shop ..... To .....

JOB PROGRESS

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	C1	C2	C3	C4	C5
C6	C7	C8	C9	C10	C1A	C1B	C1C	C2A	C2B	C2C	C3A	C3B	C3C	C4A	C4B
C4C	C5A	C5B	C5C	C6A	C6B	C6C	C7A	C7B	C7C	C8A	C8B	C8C	C9A	C9B	C9C

Tests: 1st Qu..... Mid Term..... 3rd Qu..... Final.....

WEEKLY WORK & CONDUCT MARKS

	SEPT.		OCT.		NOV.		DEC.		JAN.		FEB.		MAR.		APRIL		MAY		JUNE	
Week	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W	C	W
1st																				
2nd																				
3rd																				
4th																				
5th																				

CHARACTER TRAITS

Neat ..... Original ..... Persevering .....
Slovenly ..... Obedient ..... Gives up easily .....
Honest ..... Impulsive ..... Ingenious .....
Dishonest ..... Self Control ..... Leader .....
Quick ..... Cooperative ..... Moody .....
Lazy ..... Independent ..... No interest .....

COMMENTS:

Fig. 2

48 jobs in the course, where a mark can be placed which will correspond with the one on the progress chart. This will eliminate running to the chart when it is necessary to look up a student's record, as the card is for the teacher's use only.

Personal Progress Record Book

This book was designed in the hope that it might lead to some uniform method of keeping track of the work done by a boy during

COMPOSITION

Information or Job	Times Done
Setting and holding composing stick, pickup and place type in stick and setting words.	
Learning layout of type case.	
Remove and distribute lines of type from stick.	
Setting sentences and justifying	
Cleaning and distributing type.	
Taking proofs in stick.	
Reading and rejustifying lines in stick.	
Setting straight matter - reprints-	
Tying up on galley.	
Taking proofs in galley	
Correcting from proof reader's marks.	
Point system	
Setting Centered Lines	
Proof Reading	
Resetting type to narrower measure	
Setting Hanging Indention.	
Setting Regular Paragraph Indention	
Setting Diagonal Indention.	
Setting Simple Title Page-	
Setting Squared Indention	
Setting Table of Contents	
Setting Inverted Pyramid Indeation	
Setting Advertisement.	

COMPOSITION

Information or Job	Times Done
Layout and set business card-	
Layout and set billhead	
Layout andset letterhead	
Layout and set ticket	
Planer proofs	
Setting ruled forms	
Setting tabular matter	
Setting jobs involving use of leaders	
Breaking up jobs for colors	
Setting cover or title page	
Composition having initial letters	
Setting type around cuts	
Making up linotype pages	
Making up pages with folios	
Making press corrections	
Setting typewriter type	
Borders with butted brass rules	
Borders with mitered rules	
Using piece border.	
Composition with swash letters	
INFORMATIONAL MATERIAL	
History of the trade and Opportunities	
How type is made	
Safety	

LOCK - UP AND IMPOSITION

Information or Job	Times Done
Lockup centered forms	
Lockup off center forms	
Two page work and turn	
Work and tumble, work and twist	
Register forms	
Squaring forms	
Foundry forms	
Lockup linotype, monotype etc.	
Safety	
JOB PRESS WORK	
Oiling Press	
Inking	
Putting on tympan sheets	
Makeready type	
Makeready cuts	
Feeding card stock	
Feeding paper stock	
Setting fountain	
Slip Sheeting	
Mixing inks	
Scoring	
Numbering	
Cutting Friskets	
Setting rollers	

JOB PRESS WORK

Information or Job	Times Done
Changing rollers	
Washing Press	
INFORMATIONAL MATERIAL	
Kinds of ink and manufacture	
Manufacture of rollers	
Types of presses and processes	
Manufacture of paper	
Grades of paper	
Humidity	
Fire hazards	
Safety	
BINDERY WORK	
Hand Folding	
Collating	
Stitching	
Round Cornering	
Perforating and Punching	
Cutting Stock	
Trimming	
Padding	
Inspecting and Wrapping	
Counting Sheets	

BINDERY WORK

Information or Job	Times Done
Jogging Sheets	
INFORMATIONAL MATERIAL	
Machine folding	
Ruling Machines	
Sanitation	
Safety precautions	
History of Bookbinding	
MECHANICAL TYPECASTING	
Linotype	
Monotype	
Ludlow	
Elrod	
LAYOUT AND DESIGN	
Meaning of Design	
Methods of Design	
Appropriateness	
Tone Harmony	
Shape Harmony	
Balance and Proportion	
Legibility	
Thumbnail sketches	
Working sketches	
Use of Type Faces	
Paper as part of Design	

LAYOUT AND DESIGN

Information or Job	Times Done
Selection of Borders and Ornaments	
a. Classifying type faces	
b. Type families and series	
c. Expressing thoughts with type	
d. Design using borders and rules	
e. Borders and ornaments	
Book design	
a. Parts of the book	
b. Size - fitness to purpose	
c. Margins	
d. Folios	
e. Extracts and notes	

Fig. 3. Personal progress record which may be made up in book form

Some Typical Job Sheets

Job Sheet A7
SETTING CENTERED LINES

Before beginning to work, read every word of this job sheet carefully.

Aim of Job

To teach you how to set lines of type in the center of a measure by properly placing spaces and quads.

Things to Know

1. The copy for your previous jobs has been straight matter. In this job you will use copy that is a form of simple display. By combining long and short lines we vary the white space on each side of them and therefore they stand out prominently or are displayed. This form of display is used on title pages.
2. Your previous jobs have taught you something about the use of type, spaces, and quads in forming words and lines. This job will teach you about lines in which the words do not fill the measure.
3. In setting each line be sure to have it in the center of the measure in your stick by placing an equal number of spaces and quads on each side of the line.
4. Where the name appears in the copy you may insert your own name and where the school and its address appears, use the title and address of your school.
5. The measure on this job will be fifteen picas. Envelop corners similar in style to this job are usually set to fifteen picas, as this is a furniture length and simplifies locking up for the press.
6. After setting each line, read it over and correct all errors, before justifying. This will enable you to set a clean job and make it unnecessary to make corrections after proving. This is a very good habit to form. It will save you from wasting valuable time.

Materials and Equipment

Case of 12 point type, leads, slugs, composing stick, galley, tie-cord.

Things to Do

1. Set your composing stick to fifteen picas and place eight leads and two slugs in your stick. No more than this number of leads and slugs are required for this job.
2. Follow copy closely and use 3 em space whenever possible between words in this job.
3. Proceed with the setting of the job. As you set each line, read it over carefully for possible errors. Then place it in the center of the measure by putting an equal number of spaces and quads on both sides of the line. When there is room use two and three em quads on both sides of the line. Complete the centering and justification by using smaller quads and spaces. Always place the smaller spaces next to the type in centering a line.
4. When your job is complete, place one of the slugs you inserted in your stick at the beginning, at the head of the job and one at the foot. Remove the job from the stick, place in your galley, tie up and pull proof. Submit this proof and job sheet to your instructor for his approval.

Copy for Job

Set this job according to instructions and suggestions in the previous parts of this job sheet.

This Job of Centered Lines
is set
in 8 Point Spartan Bold
by
William F. Murphy
at the
Lincoln Hall Print Shop
Lincolndale, N. Y.

Questions

1. In centering lines, how should the quads be placed?
2. Where do you put the spaces that are used to justify a line?
3. Why are envelope corners usually set to fifteen picas?
4. Why should you read over the lines of type in your stick?
5. Describe in detail, how you proceeded to set and center the lines of type in your stick.

Job sheet C6 is an example used for assigning supplementary jobs. Sheet C6 deals with the subject of printer's ink. Much material of this kind is available for making up sheets of this kind.

Job Sheet C6
SUPPLEMENTARY JOBS

Squared Indention

Copy for Supplementary Job C-6a

Set this job with a squared indention 20 picas wide. Indention is to be one em.

In 1823, Savage, who had studied the manufacture of printing ink from the point of view of the practical printer published a book in which he discussed the various methods of manufacture. His recommendation of old linseed oil brings forward an idea that has since received considerable attention from inkmakers, namely, that the oil used for printing ink must be carefully purified. An old oil would, of course, be comparatively free from foots or sediment. In case such an oil is not available, mechanical means must be employed to clarify the fresh oil.

Copy for Supplementary Job C-6b

Set this job with a squared indention 20 picas wide. Indention is to be two ems.

The eighteenth century developed the idea of adding a blue coloring matter to neutralize the yellow of the oil, using for this purpose Prussian blue and indigo. The nineteenth century saw the development of the anilin dye industry, following the synthesis, by Perkin, of mauve, the first anilin color. Meanwhile, owing to a desire to reduce the cost of ink as well as to secure inks which would work better on the various grades of paper being made, new oils were being introduced into the vehicles. First of all came the introduction of rosin and rosin oil, followed by mineral oil, the long gilsonites (the latter furnishing both vehicle and pigment), the semi-drying oils, and China or tung oil.

Copy for Supplementary Job C-6c

Set this job with a squared indention 20 picas wide. Indention is to be three ems.

We thus arrive at the twentieth century, and find the materials for making printing inks pretty thoroughly studied, and in general very much what they were in the beginning. Recent advances have been along the line of mechanical devices for the manufacture of large quantities at a minimum of cost. So far as materials are concerned the principal progress has been in the preparation of colored inks, used so effectively in multicolored lithographic work.

his schooling, regardless of whether he completes his work in the school he started in or not. It is to be noted that the operations and not jobs are recorded.

Job Sheets

Unless a teacher is extremely fortunate in finding some when he comes to a school, his biggest task will be the making up of job sheets. The two shown above are offered as a guide to those who have to make up a set. Printed on strong tag stock and punched for rings, they will last for years. As the boys advance, they can take over the job of setting and printing these sheets, but the job of preparing them still rests with the instructor.

At the end of some of these job sheets a list of questions about the work done by the student has been added. The answer to these questions will be found in the sheet itself. This will help to develop in the student the habit of reading his copy carefully, a habit that will be invaluable to him if he follows the printing trade.

Safety

One of the most important things that a shop teacher must impart to his students is the practice of safety. Most schools require that the student sign a statement that he has received instructions and demonstrations on the safe practices of his trade. The blank side of the report card may be used for this statement.

Outline of Instruction for Industrial-Arts Metalwork

GERALD L. WALTRIP*

The outline shown here has been compiled as an indirect source of information for students and as an organized method of instruction for the teacher. It is intended to cover a period of nine weeks; however, the time allotment will vary with different situations, including schedules, types of shops, grades taught, and equipment.

Objectives

1. To give guidance in the development of interests, aptitudes, and creative ability.
2. To give an insight into the working knowledge of fundamentals involved in metalworking trades and industries.
3. To develop manipulative skills necessary in basic industrial-arts processes.
4. To develop handy-man abilities in making necessary home repairs.
5. To develop thrift and appreciation in the utilization of products of industry.
6. To provide an opportunity for exploration of individual inclinations, interests, and abilities.
7. To develop an appreciation for good design and workmanship.

Scope

1. Fundamental tools and operations as applied to making things of metal.
2. Common methods of fastening metal together.
3. A study of *jigs*, their general importance to industry, and their application in bending metal.
4. Methods of finishing metals.
5. A study of information related to this unit of work.

*Public Schools, Oklahoma City, Okla.

Use of the Outline

It is suggested that the teacher list a number of problems and divide them into groups according to a satisfactory sequence of tool processes and operations. In this way the student advances from the elementary to the more difficult operations, which in turn involves the use of more tools. A general outline listing operations, tools, materials, and related information, should accompany each problem.

The fundamentals of laying out, cutting, shaping, drilling, assemblying, and finishing, can be taught in a comparatively short time, and by using simple problems. However, as the problem under construction becomes more difficult, additional information involved in the operations and tool processes are brought out, consequently the student advances in knowledge as the work becomes more complex and harder to perform.

As soon as it is felt that the student has had enough training, through class discussion, demonstrations, and written information, he should be placed in a more independent position. That is, he should be able to select from the outline of instruction those units of knowledge related to his problem, and for the most part, work out his own procedure. This would naturally be accomplished by consulting the references and through suggestions from the instructor.

Tools

The student should keep in mind the following facts when making a study of the various tools:

1. The name of the tool and its principal parts.
2. The function of the tool and its various parts.
3. Proper selection of tools in performing various operations.
4. How to use and care for tools.
5. Safety to one's self, to others, and to the tools.

Reference Books

1. Berg, Edward and Wing, Bristol E., *Essentials of Metalworking* (Peoria: The Manual Arts Press, 1934), 160 pp.
2. Bollinger, J. W., *Elementary Wrought Iron* (Milwaukee: The Bruce Publishing Co., 1930), 139 pp.
3. Grayshon, Alfred B., *General Metal Work* (New York: D. Van Nostrand Co., Inc., 1930), 206 pp.
4. Lukowitz, Joseph J., *Interesting Art-Metal Work* (Milwaukee: The Bruce Publishing Co., 1936), 63 pp.
5. Tustison, F. E. and Kranzusch, Ray F., *Metalwork Essentials* (Milwaukee: The Bruce Publishing Co., 1936), 176 pp.
6. Van Leuvin, Perry E., *Cold Metal Working* (New York: McGraw-Hill Book Co., Inc., 1931), 275 pp.

Outline of Instructions

Problem	Knowledge Gained	Reference No.	Reference Pages
	Tools for Measuring and Laying Out		
1. Rule	Kinds	1	12
	How to read	5	1–4
	Use for laying out and dividing		
2. Square	Kinds	1	14–17
	For use as a guide	5	7–9
	For laying out		
	Testing for squareness		
3. Scriber	Use for marking centers	1	13
	Scribing around patterns	5	2–3
		3	23
4. T bevel	Use for marking off angles	6	94–96
	Use for testing angles		
5. Dividers	For stepping off like distances	1	17–18
	For scribing circles	5	11–12
	For measuring irregular material	2	11
	For fitting irregular pieces		
6. Center punch	Use for starting a drill	1	18–19
	How to correct errors in center punching	5	10–11
		3	23–24
7. Calipers, outside	Use for measuring outside diameters	1	20–21
	How to set and transfer measurements	3	38–39
	Technique of contact measurement		
8. Calipers, inside	Use for measuring inside diameters	1	21–23
	How to set and transfer measurements	3	38–39
9. Calipers, hermaphrodite	Use for scribing parallel lines	1	23
	Use for locating centers		
10. Micrometer	How to read	1	23–25
	How to hold	3	39–41
	Care in handling		
	Tools Used in Cutting and Boring		
11. Hack saw	Kinds — specifications of blades	1	29–31
	Care and method of use	2	14–15
		5	77–79
12. Cold chisel	Kinds and shapes	1	32–34
	Care and method of use	5	80–84
	How to sharpen	3	18
13. Files	Sizes and shapes	1	35
	Classification	1	36–38
	Cross and draw filing	1	39
	Care of files	1	38–39

Problem	Knowledge Gained	Reference No.	Pages
14. Emery cloth	Grades and how to use	3	20–21
15. Drills (twist)	Sizes and description	1	39–41
	Care in the use of	1	41–42
	How to sharpen	1	42
	Speed of drill	5	54–61
	Methods of holding stock	1	46
	Use of small pilot holes		
	Amount of pressure to use		
	Use of lubricants		
16. Hand drills, breast drills, and brace	Sizes — gear ration	6	42
	Use of level in accurate drilling		
17. Tin snips	Kinds and sizes	5	13–16
	Use for cutting and forming sheet metal	1	31–32
18. Power drills, drill presses	Method of controlling speed	5	57
	Pulley ratio	3	22
	Sizes and adaptability to different situations		
19. Reamers, pipe	Use for cleaning up burr edge in pipe	1	47–49
		5	142
20. Countersink	Use for bolting and riveting	1	49
21. Taps	Kinds and common sizes	1	50–53
	Determining size drill to use	5	131–135
	Holding stock		
	Care and method in the use of		
	Common types and sizes of screw threads		
22. Dies	Kinds and common sizes	1	53–54
	Care and selection in the size of	5	136–139
	Method of holding stock		
	Cutting and lubrication		
Tools for Holding, Shaping, and Assemblying			
23. Hammers	Kinds and sizes	1	57–58
	Use for riveting, cutting, decorating, shaping		
24. Anvil	Weight	2	3–5
	Parts and use of each	6	18–19
	Accessories used		
25. Machinist vise	Size and kinds	1	58–60
	Care and safety in the use of	3	17
26. Drill press vise	Use for drilling holes	6	73
	Care and safety in the use of	5	60
		3	22–23
27. Screw driver	Sizes, care, and use	1	60–61
	Correct shape of blade		
28. Rivet set	Use for setting rivets	1	113–114
	Use for shaping rivet heads		
29. Monkey wrench	Sizes — uses	1	61–62
	How to use		
30. Pipe wrench	Sizes — uses	1	62–63
	How to use		
31. Pliers	Sizes — kinds	1	63–64
	For gripping and bending light work		
	For cutting small wire		
32. Clamps	Kinds — sizes	1	64–65
	Use for holding material		
33. Bending jigs	Use of the bending fork and lever	4	10–11
	Use of the scroll form	4	12–13
	Use of the scroll form jig	4	14–15
	Uses of iron pipe	6	28, 117
		5	119–122
Materials			
1. Band iron	Uses and adaptability to cold-metal work in the shop and in industry	1	83–86
		6	224
	How it is manufactured		
	Common sizes and how purchased		
2. Sheet metal	Kinds and specifications	1	97–101
	Gauges most commonly used	5	157–164
	How it is manufactured		
	Use and importance to industry		
3. Rivets	Kinds and sizes adapted to small work	1	112–114
	Kinds and sizes adapted to construction work		
	Use and importance to industry		
	Manufacture of rivets		
4. Bolts	Common kinds and sizes	1	114–120
	Use for repairs and in construction		
	Uses and importance to industry		
	Manufacture of bolts		
5. Finishing	Reasons for and preparation of the surface	5	103–107
	Hammered finish		
	How to apply opaque finishes		
	How to apply transparent finishes		
	How to produce an oxidized finish		
	How to apply a smoke finish	2	47–49

Operations

Measuring and Laying Out

	No.	Pages
1. Superimposition	5	1–12
2. Transferring from pattern	2	11–14
3. Laying out directly on metal		
4. Determining length of irregular pieces		

Cutting

1. Shearing	5	13–16
2. Sawing	5	77–86
3. Chipping, chiseling	2	14–17
4. Breaking		

Shaping

1. Curved bending	5	118–122
a) Circles	2	23–31
b) Scrolls		
c) Irregular curves		
2. Forming angles	5	108–113
a) Right angles	2	22
b) Given angle		
3. Twisting	5	114–117
a) Dividing into sections		
b) Use of iron pipe		
4. Flaring	2	19–20
5. Tapering	2	17–19
6. Raising	5	72–76
	2	31–32
7. Filing	5	87–92
a) To given diameter		
b) To a given square		

Drilling

	No.	Pages
1. Locating centers and center punching	1	39–42
2. Holding stock in vise	5	54–61
3. Drilling for taps and for rivets	5	10–11
4. Speed of drill	1	18–19
5. Sharpening drills		
6. Countersinking — rivet and bolt heads		

Assembling

1. Fitting parts together		
2. Order of procedure		
3. Riveting	5	123–127
	2	38–39
4. Bolting	2	39–41
5. Tapping holes	5	131–135

Finishing

Refer to materials, problem 5, of this outline.

Related Information

The following topics may be used for class discussion or student reports.

1. History of iron
2. Manufacture of wrought iron, cast iron, steel
3. Use of iron and steel in industry
4. Trade opportunities in the metal industries
5. Rust, its effects and prevention
6. Corrosion, its effects and prevention
7. How rivets are made
8. How bolts and nuts are made
9. Properties of common metals
10. Annealing and tempering steel
11. Case hardening of steel

A List of Suggested Problems

This list is given in order to aid the student's selection of a problem within his ability and experience. Problems shown in the references may be supplemented by those found in the shop, or by suggestions from the student.

Problem	Reference No.	Pages
1. Coping saw	3	142
2. Bridge lamp	2	130
3. Bicycle bundle rack	3	134
4. Dish cloth rack	6	161
5. Door knocker	2	84
6. Flowerpot bracket	4	41
7. Foot scraper	2	83
8. Magazine basket	2	82
9. Portable campfire grate	2	66
10. Scroll candlestick	4	21
11. Shelf bracket	3	130
12. Tack hammer	3	146

An excellent source for locating metalworking problems will be found in the following reference:

Williams, Amos G., *A Guide to Metalworking Problems*, Industrial-Arts Department, Iowa State College, Ames, Iowa, June 1, 1935.

BUILDING-TRADES COURSE WHICH BUILDS

C. B. Cooley*

The building-trades classes at the Branch Agricultural College, Cedar City, Utah, really build. These training classes are conducted under an A-type program, as set up by the Trade and Industrial Division of the United States Department of Education and are in operation five hours per day for a two-year period. The program has been operating for the past nine years.

The plan for this training is as follows: The class is limited to 20, and during each school year it designs and constructs a complete modern home which is later sold at public auction. The structure is built to meet the best building practices, including requirements set up by the Federal Housing Administration, and the strict Cedar City building ordinance.

Nearing completion is the 1940–41 project. It will be sold at public auction in May

Students laying floor joists on the 1940–41 project

During his first year, each student is assigned the responsibility of drawing and blueprinting a house plan. The class, under the direction of the instructor, selects the best plan, sometimes incorporating good points from several. This plan is then used for the next year's building project.

The boys are assigned any duties incident to the construction of the house, during the first year. The second year they are encouraged, besides carrying on their general building duties, to specialize in a favored activity such as plumbing, painting, plastering, carpentering, or related activities.

Instruction is so arranged within the two-year training period that a student receives a complete basic experience in blueprint reading, architectural drafting, building estimating, and other technical training related to the building trades.

A set of tools is assigned to each student at the beginning of his first year. At the end of his second year he is awarded his tools if he has completed all requirements of the program. Thus, in training and equipment, he is prepared to enter the industrial world.

This program, besides training a student in a practical building situation, provides him with employment between the training periods. Last year 70 per cent of all trades students were employed by building contractors. Ninety-five per cent of the graduates for the past few years are now working at their trade.

The 1940–41 project consisted of a five-room structure with complete and finished basement. This was the seventh project completed by the department in the past nine years. Three of the other projects are on the school campus, the director's cottage and two units of the boys' dormitory. The other three projects were modern homes and were sold at completion. If any profit is made from the sale, it is added to the building fund which was started nine years ago by a grant from the board of trustees of the parent institution at Logan, the Utah State Agricultural College.

Experience with this program leads the officials of the Branch Agricultural College to recommend it as the best program with which they are familiar for the teaching of the building trades.

Building-trades students of the Branch Agricultural College, Cedar City, Utah, lay out and place the rafters on the 1940–41 project

*Assistant Professor of Industrial Arts, Branch Agricultural College, Cedar City, Utah.

School Shops

Development, Use, and Evaluation of an Arts Workshop

FRED J. SCHMIDT, JR.*

With the emphasis in education being placed on general knowledge, experiences, and whole problems, it becomes ever more challenging for each area of school content to learn just how it may accomplish this emphasis. Workers in the educational field feel it their duty to learn how they may contribute to this broader attack. They are anxious to learn what other fields may be drawn upon to enrich their own program.

The new emphasis on program enrichment to better meet individual needs presents problems which can be developed most efficiently through a united effort. Subject barriers have at least been removed, if not entirely broken down, to the extent that cooperative effort has become somewhat easier.

It was this realization of need for cooperation, the desire to learn relationships and integrate them, and finally to do something about it that led faculty members of the art, English, household arts, industrial arts, and music departments of the Burris Laboratory School, Ball State Teachers College, Muncie, Ind., to attempt a clarification of a philosophy and its translation into a physical plant which they hoped would make the desired integration possible. This effort resulted in the present Burris-Arts Workshop.

*Associate Professor of Industrial Arts, Ball State Teachers College, and Chairman, Arts Workshop, Burris Laboratory School, Muncie, Ind.

How the Program Was Developed

The roots of inception of the arts workshop may be traced back several years to experimentation with unified courses in art, music, English, industrial arts, and household arts in the junior high school. At that time realization began to grow that, try as one might to separate these areas of learning by physical plant, the subject matter itself just would not remain separated. Problems in one area began to demand assistance better furnished by other areas. It was realized that art, to be functioning, must serve all of the arts. Relationships not to be denied began to show themselves. A recognition of a few relationships pointed directions for others, until through a rather natural approach, area or subject-matter lines began to crumble. At first, pupils working in any one area made use of other areas only as such activities could be worked out by teachers or pupils outside of class. Later, larger group problems were undertaken involving activities in several areas. The final outcome was that pupils were given as much freedom as need be to solve problems in the quickest way possible, and with as little inconvenience as possible. At this stage, pupils were permitted to go to English, music, art, household arts, or industrial-arts quarters at any time a need was indicated by the problem under consideration. It was quite evident, however, that because of distance and the inconvenience of passing from area to area, pupils often failed to utilize opportunities of which they should be availing themselves. Out of this experiment arose the

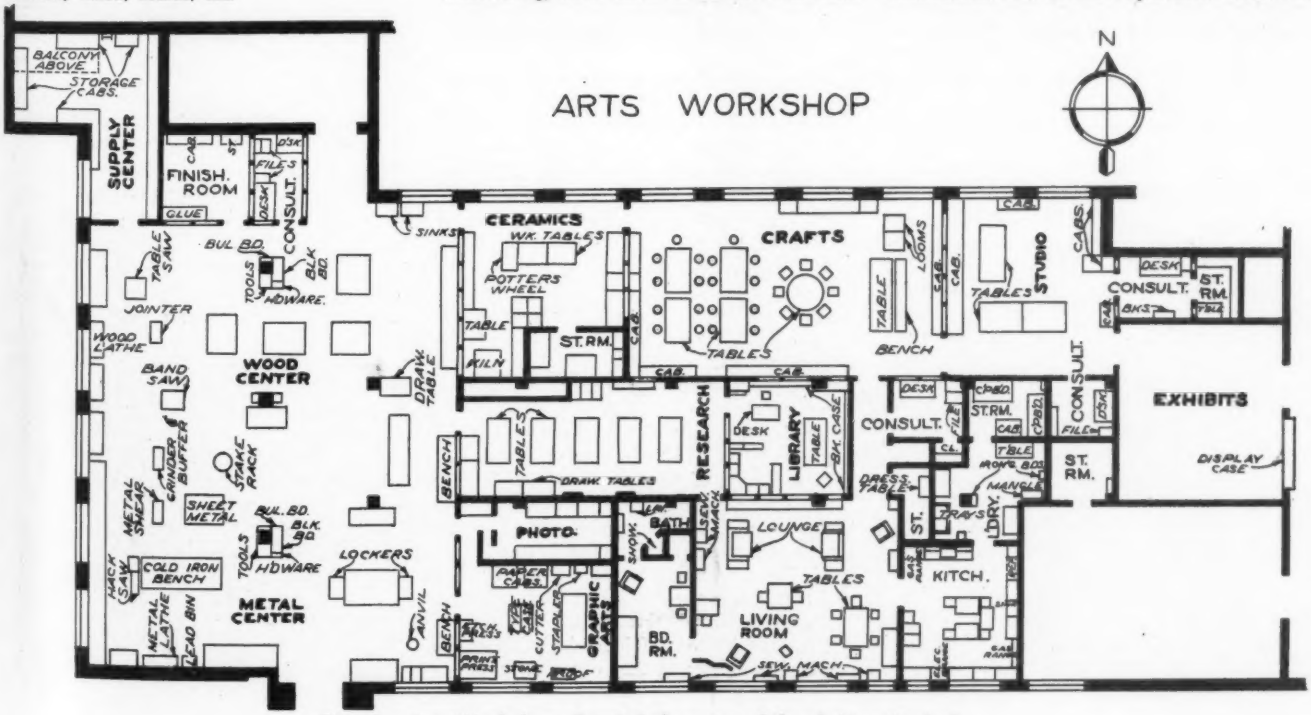


Fig. 1. Arts Workshop, Burris Laboratory School, Muncie, Ind.

Research Center, looking east

Library Center

problem of proper housing of an integrated type of program for art, household arts, and industrial arts.

Although a unified or integrated program was demonstrated as possible in a situation where area quarters were widely scattered, it was believed that certain plant adjustments would tend to stimulate more efficient work, and would more adequately meet pupil needs.

After consideration of the number of subject areas involved, it was apparent that the physical plant would not adapt itself to the inclusion of all subjects which might eventually be drawn into such arrangement. The problem, therefore, became one of sorting out the more closely related areas. Those finally decided upon were art, household arts, and industrial arts, which were classified under the general term, "The Arts." This division resulted not only because of the relationships existing between subject content, but also because of the point of philosophy which holds that boys as well as girls should be permitted to take household arts and that girls as well as boys should be permitted to take industrial arts.

The Philosophy

If such an elaborate program of experimentation was to be approved and successfully planned, it was realized that the philosophy would need to be more carefully studied and crystallized to a point where it might serve to give direction to a building program. With this in mind, an extensive study program for the purpose of clarifying the point of view or philosophy was launched by the faculty of the unified courses. Out of this program of study grew summarized points of view which the group could subscribe to and consider adequate as guides for the future development of plant and program for an arts workshop. The selection, as far as possible, was based on the determined needs of the pupils. The summation of these points of view, later used in an evaluation of the arts workshop and called principles of philosophy, follow:

Principles of Philosophy: The arts should contribute to fuller, richer living in the following ways:

1. They should introduce the child to the heritage of his own race and that of the world.
2. They should have a universal appeal; for form, color, and rhythm have interest for everyone.
3. They should encourage and foster creative work.
4. They should provide for exploration with as many materials and techniques as possible.
5. They should enrich life by opening up numberless fields of activity and thereby aid in developing a worth-while disposal of leisure time.
6. They should have therapeutic values, since they provide outlets for the emotions and suggest many activities which can occupy the mind and hands.
7. They should not be thought of as a field in themselves but as being closely related to other subject areas.
8. They should seek to inform the pupil of present social and economic problems.
9. They should develop in the child a wiser and more sympathetic understanding.
10. They should lead the individual to an increasing awareness of the world in which he lives — the wonders of nature, the production of man's hands.
11. They should develop a sensitivity to surroundings as a reflection of personality.
12. They should contribute to the development of the student's personality and help him make social adjustments.
13. They should help to make the student a more appreciative person, for his work with media develops his understanding of the activities, the steps, and the evolution involved in the production of things.
14. They should provide, through many experiences, a finer appreciation for the problems and beauties of abundant living.
15. They should give the child a broader and more tolerant outlook on life.
16. They should, through the diversity of activities, take care of individual differences. Through some phases they offer deep satisfaction to the person of most highly developed aesthetic powers; on the other hand, there are certain simple processes that satisfy the person of very meager abilities.
17. They should start with the child at his own level and through experiences help him to raise his standards.
18. They should place the emphasis on growth within the individual as a learner rather than upon the quality of his production.
19. They should permit secondary experiences through the observation of the work of others.
20. They should equip the child with desirable techniques for self-expression and intelligent effective participation in the home, in the school, and in the community.
21. They should help to develop a child socially by giving him an opportunity to share equipment.
22. They should help the pupil to develop a plan for the attack and solution of life's problems through the selection, planning, execution, and evaluation of problems, ideas, and experiences.

How the Philosophy Determined the Plant

The arts workshop as it now exists, consists of the entire first floor of the south wing of the Burris Laboratory School, as indicated in the floor plan in Figure 1. It consists of an industrial-arts area,[1] a ceramics center,[2] a crafts center, a studio center, a household-arts area, a planning center, a library center, a display center, a number of storage centers and offices, and provision for elementary grade work in those situations where the individual-grade workshops prove inadequate. Wherever the activity itself permits, glass partitions separate the various types of activities. A sufficient number of doors to make all centers available to all pupils at all times have been incorporated. Every effort has been made to

[1] *Area* is the name given to a number of centers. The arts workshop consists of three areas, namely: art, household arts, and industrial arts. For example, the art area consists of an art studio (drawing, designing, painting, crayon work, etc.), a leather center, a light-metal center, a textile center, a bead center, and a ceramics center.

[2] The term *center* applies to any space in the arts workshop proper where a specific type of work is carried on, as the leather center, the cooking center, the electrical center, or the printing center.

make the arts workshop as attractive as possible. Plans and equipment have been governed by the philosophy which has been developed through practice. The underlying principles of this philosophy are to make the activity in the arts workshop a living situation, permitting as much pupil freedom as possible.

To assure a plant which would adequately supply facilities for the realization of the philosophy developed, some rather unique procedures were adopted. The administration, in place of dictating, gave almost complete freedom to the arts teachers for the planning of plant and storage and the selection of equipment. Where controversial issues arose, combined meetings of the arts teachers, administrators, and architect were held. In very few instances was a decision made by one individual. The architect, better to learn the needs, spent an entire year observing classes and studying the philosophy.

Scaled floor plans were continually revised in light of more recent thinking. Upon them were played, in checkerboard fashion, miniature and scaled cutouts of equipment and furniture to be included in the new plant. A different color of cutout was used for each of the areas of art, household arts, and industrial arts so that one could readily follow center relationships as they developed. Such plans and cutouts were kept out in the open where pupils, teachers, administrators, the architect and visitors might see them at any time for the purpose of study. In this manner many valuable suggestions were made use of and incorporated in the final plans.

The final results of these efforts appear in Figure 1. Since the philosophy was developed in terms of the needs of the child, a development of the plant in terms of the philosophy also made provision for individual child development.

Floor Plan

In developing the plan, the philosophy based upon observable pupil needs and anticipated future needs served as a check for determining what should be included and how it should be included. Such procedure necessitated the consideration of all relationships between the subject areas included and the philosophy accepted.

Since the philosophy stresses pupil integration and pupil freedom, it has been necessary to give much attention to area and center integration of all things of a physical nature relating to art, household arts, and industrial arts. Although halls are a necessary part of standard school-building construction, even a quick overview of the problem indicated that the continuity hoped for in the arts workshop would be seriously interfered with if such a standard were to prevail. For this reason no halls appear in the entire arts workshop.

The philosophy accepted for the arts workshop provides for careful planning and preparation for the various problems undertaken by boys and girls enrolled in the arts workshop. This planning, plus emphasis given to experimentation and research, necessitated special facilities for the proper development of problems. It is natural, therefore, that an attempt would be made to locate centrally any part of the plant which would provide the necessary facilities for carrying out this principle of philosophy. By reference, therefore, to Figure 1, one sees that the research center and the library center are located at the hub of the total plant, that easy access is provided to these centers from the larger areas of art, household arts, and industrial arts, and that glass partitions provide views, for supervisory and observational purposes, from each of the larger areas.

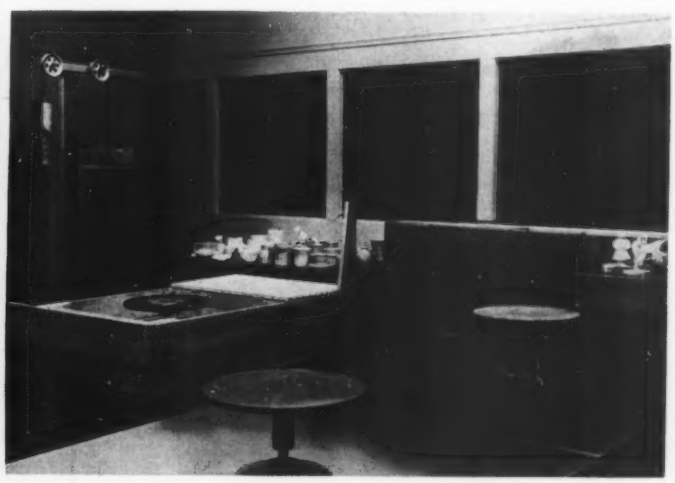
The exhibits center, Figure 1, although considered an integral part of the research and library centers, does not immediately adjoin these centers. Its incorporation with the other two centers has possibilities in the form of study and research because in the exhibits center are displayed materials of inspiring and instructive nature as well as the results of arts workshop activities. On the other hand, it was felt that the exhibits center should be so situated as to be easily accessible to the entire school and also as to make it necessary that at least a part of each arts workshop class pass through it on the way from class. Should the exhibits center adjoin the library and planning centers there would be interference with concentrated study in these two centers and their use by individual pupils or groups engaged in serious study and development of problems would be somewhat limited. After much careful study of the problem it was decided that a more extended use of the exhibits center would result in placing it where it is now located. Such location still makes the exhibits center accessible to pupils needing its help. It should again be noted that around these three centers, namely the research center, the library center, and the exhibits center revolve much of the very basic effort of pupils and teachers in the development of the type of problem it is hoped will help better to integrate the individual.

Doors have been efficiently placed so that the ease of accessibility between centers, as accepted in the principles of the philosophy, has been provided for. A principle of philosophy providing for secondary experiences through observation has been provided for through the incorporation of glass partitions, wherever possible, through provision of adequate space in the various centers, and through the provision of many doors as previously stated. These provisions all tend to help break down the feeling of isolation of area content and to establish the oneness which the philosophy emphasizes.

Storage space so essential to any type of laboratory work, is clearly indicated on the floor plan in Figure 1. Much of this storage space is found in the form of specially designed cabinets.

Before completing the arts workshop plans, it became necessary to decide upon a policy of elementary grade instruction in the arts. Two possibilities offered themselves, namely, a separate plant for the elementary grades or provision in the arts workshop for caring for this phase of the arts work. Since each elementary grade has its individual workshop, it was decided that a more satisfactory way of handling this instruction would be for the elementary teachers, under supervision, to do the basic arts work in their individual workshops at such time when the work related to actual classroom instruction. At such times when the work became too complicated or extensive, problems were to be taken to the arts workshop. The latter policy was adopted be-

Studio Center, looking east



Ceramics Center, looking west

Livingroom Center, looking east into Kitchen Center

Livingroom Center, looking into Planning Center and Library Center

cause it eliminated the necessity for extra staff in a separate shop situation, eliminated duplication of materials and equipment, made possible a greater variety of supplies and equipment, made use of adequately trained faculty already employed, and above all introduced the elementary grade pupils, in gradual stages, to a shop situation in which they would later spend considerable school-time.

An effort has been made to provide adequate space for future expansion and thus meet the demands of the principle of philosophy which recommends that the program be broad enough to provide for demonstrated pupil needs.

Results indicate that school needs can be met much better when a careful study of the requirements for a definite program is made, and that departure from standard practices sometimes operates more efficiently to meet such needs.

Construction Represented in Plant

The philosophy of the arts workshop specifies quarters that provide facilities which will encourage the development of healthy, happy, socially adjusted individuals. Such specifications make necessary a careful study of and provision for various facilities.

Studies in industry indicate that individuals are happier and work more efficiently in surroundings which take account of the mental and physical comfort of the individual. With the pupil and his needs in mind, the type of construction has been, as nearly as it was possible, adjusted to such recognized needs.

Ventilation in the arts workshop has been adequately provided for through two industrial-type ventilation-heating units, one located in the northeast corner of the industrial-arts area and another in the ceramics center. These ventilating units are hung from the ceiling. Fresh air is drawn over heating elements by large fans which distribute the fresh, filtered, and heated air from the outside to the various centers of the arts workshop.

Further provision for the change of air in the arts workshop is made through individual Univent air conditioners located at various points along the outside walls of the art area and household-arts area.

Although some heat may be provided by the ventilating units, the major portion is supplied through steam radiators placed along the walls of the art area and the household-arts area and hung from the ceiling of the industrial-arts area.

Facilities for lighting both by daylight and artificial light are adequate. The artificial light is supplied by semi-indirect units. These units are properly spaced and equipped with a wattage high enough to supply an even illumination of the proper intensity for the center being lighted. This statement implies that different foot-candle powers are supplied for the different needs presented in the various centers. It can readily be seen that the intensity of light in the foundry center is entirely a different problem from that of the research center. The research center, requiring close work, would need the higher candle power.

Some objections were raised in the course of early planning regarding the advisability of placing a center, such as the research center, needing the best type of lighting, at the hub of the development, where a minimum amount of daylight would be available. It has been proved, however, that by using indirect artificial light a more uniform light of exactly the right intensity can be supplied. It, therefore, happens that the most successful lighting situation found in the arts workshop is that of the research center, where dependence for proper lighting is placed almost wholly upon artificial lights.

The problem of avoiding glare from large expanses of window area on the south and west was solved by installing Venetian blinds. This installation not only eliminates glare but also permits adjustment for reflection of light into sections of the plant farthest removed from outside walls. In fact so successful is this arrangement that on a day of average brightness the light in the library is adequate for comfortable reading without artificial light. This is made possible by reflected light distributed by the Venetian blinds from the crafts center and household-arts area.

In the household-arts area the problem arose of movable partitions between the personal grooming and living-room centers and between the living-room and kitchen centers. After much careful study of the problem, the use of Venetian blinds was decided upon. They have proved entirely satisfactory as a temporary partition and have the advantage of adding much to the attractiveness of the household-arts area. Their use is indicated in the livingroom center shown above.

The problem of noise was approached in several different ways. A type of movable partition made of sound-absorbing material was selected. The material finally approved was transite incorporating sections of glass. Any of the arts workshop pictures will show the partitions. The entire ceiling of the industrial-arts area, where the most intense noises tend to originate, was covered with a noise-absorbing material, Acousti-Celotex.

Although floors did not enter into the planning of noise absorption, it has been demonstrated that the Blox-on-End floor, installed in the industrial-arts area, plays a very important part in the whole problem of noise elimination or reduction. Especially is this true in the case of power-machine vibrations and pounding noises transmitted through bench construction to the floors.

Dust is always a problem in industrial-arts and crafts areas. Partitions and floors made provision for the isolation of a number of the centers. Since woodwork machines, however, are particularly dusty, the plans provided for a dust-collecting system. The blower itself is encased under a specially designed workbench. All pipes leading to machines are located in the floor, thus avoiding, as much as possible, interference with the general appearance of the industrial-arts area proper. The separator for the blower system is located on the roof directly above the blower.

Irritating and poisonous fumes and gasses from the foundry furnace and heat-treating furnace are carried away by fans located in fume hoods. Fumes originating in centers where the amount is not large enough to warrant constructing expensive fume hoods are forced out of the center when fresh air is drawn in through the ventilating system. The ceramic glazing unit will have a separate glazing box from which a fan will draw excess glaze rising in the air.

Glass partitions have been mentioned earlier in the discussion in relation to the integration of centers of activity and also as a feature encouraging observation of work other

than that immediately in progress by the pupil himself. A large proportion of the accompanying pictures will illustrate the windows located in the movable partitions. The glass is a good quality of plate glass and therefore permits an interesting view through a number of centers from almost any point in the arts workshop. These glass areas in the inside partitions also add to the interest of the areas themselves. They have been incorporated in as artistic a manner as possible.

The large quantity of glass found in inside partitions immediately created a problem of decoration because of the fact that one is able to view so many centers at one time. The large views, basically necessary to the carrying out of the philosophy, made a careful study of wall colors, floor covering colors, colors of blinds, color in cabinets, and color in furnishing, a very difficult but important problem.

The philosophy also calls for the aesthetic and appreciative development of the child as well as his awareness of all that is proper and accepted by society in daily life situations. To make such principles of philosophy function, necessitated a most careful treatment of the problems just presented.

Since large expanses of the arts workshop could be viewed at one time, it became necessary to consider the arts workshop as a whole rather than as a number of isolated units. Added to the problem of harmonizing color and furnishing was that of color related to outside exposures, color related to the proper type of floor for certain centers, color related to the proper type of storage cabinets, and wall and floor color related to furniture.

The problem was approached first in terms of wall colors as they relate to exposures, such as north, south, or west. Cool colors were selected for south and west exposures, while warm colors were selected for north exposures.

Colors also needed to be considered in terms of adjoining centers so that one color would flow pleasingly into another rather than clash with an adjoining color. All colors selected were of pastel tints. Since the half tones do not show this feature, reference to any of them would be futile except that, if the various illustrations of the arts workshop included in this presentation are carefully studied, one can readily appreciate the importance of color because of the many centers that one is able to see at the same time. Examples may be cited which may make this point clearer. From the floor plan, Figure 1, it can be seen that one may look from the north end of the industrial-arts area through the ceramics center, the crafts center, the studio center to the exhibits center. The wall colors in the order of room arrangement above mentioned are in the industrial-arts area, a cream or light yellow; in the ceramics center, a light green; in the crafts center, a light rose; in the studio center, a light yellow; and in the display center, a Monks cloth covering of a very light tan. All colors are of tints which completely harmonize. This harmony of color aids pupils to feel at ease, to feel right aesthetically, to develop proper appreciations, and to be happy, as the philosophy specifies.

The floors, also, enter into the problem of harmonious and usable surroundings. The first requirement of a floor is, of course, usableness for the need to be served. The second problem is that of color. So far as service is concerned, both rubber and asphalt-tile floors were considered as meeting adequately the needs and color problem of all areas and centers except that of the industrial-arts area proper. In the industrial-arts area the floor finally approved was that of concrete for the foundry center and of Blox-on-End, a pine floor, for the remaining centers of the industrial-arts area.

Since rubber tile is more expensive, asphalt tile was finally selected for all other floors, although the coloring or rubber tile is much to be preferred. The color of the asphalt tile and the color of the walls were as well matched as the available tile would permit.

The concrete floor in the foundry center was left in the original gray, which matches the color of the machines, all of which are painted gray.

All Venetian blinds are a light yellow, but cords and canvas strips are matched in color to the particular wall coloring of the room in which they are installed.

Storage cabinets in all areas and centers except the industrial-arts area are of maple or birch in modernistic pattern and of natural finish which harmonizes with the other colors. Bench tops in the industrial-arts shop are of maple finished in natural wood color with green metal storage cabinets underneath. Wood cabinetwork in the industrial-arts area and adjoining centers is oak, finished in a brown which goes well with the light yellow of the walls.

Furniture in the art area and household-arts area is largely of tubular steel, with the heavy pieces upholstered in colored leather or textiles to harmonize with the colors of walls and floors of the centers in which the pieces are used.

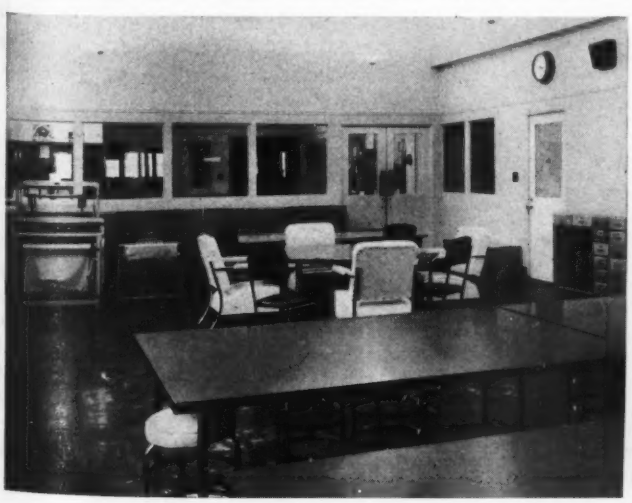
A factor of paramount importance in laboratory work is safety, of which the philosophy takes cognizance. The arts workshop must be not only a pleasant place but also a safe place in which boys and girls may work. Equipment has been selected in terms of pupil safety, and power controls have been installed which help reduce dangers to a minimum. Each machine is controlled individually and through a master switch from a power panel located on the north wall of the industrial-arts consultation center.

Through the care given in the general planning, construction, and decoration of the arts workshop, it is hoped that pupils will develop a finer aesthetic sense, a deeper appreciation of the value of harmonious working and living quarters, a finer and deeper sensitivity to surroundings, and an awareness of the world in which they live.

Materials and Storage

As large an offering as possible of different kinds of materials adapted to arts work is one of the aims set up for the arts workshop. The philosophy expresses the belief that exploration as provided by the arts workshop can be more effective in contacts with a variety of materials than it can in manipulative experiences. If this principle is sound, then the broader the offerings of materials the better prepared will the arts workshop be to aid the pupil to sample areas of human endeavor found in society.

Only, as many different kinds of materials are made available, will it be possible for boys



Crafts Center, looking east

Graphic-Arts Center, looking into Metal Center

Metal Center, looking into west end of Woods Center

Metal Center, looking into Graphic-Arts Center

and girls to be introduced to the heritage of the race. Indirectly, too, a broad offering of materials should aid the pupil in locating some avenues of possible value in present and future disposal of his leisure time.

Since it is believed that the arts have therapeutic values, such needs can be met most effectively when offerings are broad enough to meet the needs of all individuals participating in the arts program.

An individual who has the opportunity to have experiences with many materials, should indirectly become sympathetic to the work of the world, since through such experiences he learns of the difficulties encountered in the manipulation of materials used to form basic products of daily life. There is the possibility that, indirectly, appreciation of the difficulty of manipulating materials will develop a respect for the work of the world.

Because of experiences gained by the pupil with many different materials there should be developed an increasing awareness of the world in which he lives. Such experiences should develop a sensitivity to surroundings.

Although a presentation of plant, equipment, and materials used, necessarily deals with physical materials, it does not follow in the work of the centers that overemphasis is placed on manipulation. The fact is that emphasis is placed on what happens to the individual as he manipulates and studies materials; the product is incidental. After all, if aims and outcomes are set up in terms of finished products, and the change that takes place in the boy or girl while developing the problem is ignored, it might be better not to have the experience at all.

In the type of plant developed for the arts workshop and because of the method under which it operates, not all materials are in use all of the time. The needs of pupils are so varied that, as far as is possible, they must be anticipated and material stored so that a pupil may find such material when the need arises. The aim is to use standard materials whenever possible.

The arts workshop philosophy holds that, whenever possible, pupils should be permitted to help themselves to the materials and equipment needed. It is believed that such experiences have values in the light of proper selection, in the proper method of getting a small amount of stock from bulk, and in developing a proper respect for materials. This philosophy calls for an entirely different system of storage from that ordinarily found in a public school system. Unless proper and adequate storage is provided, a pupil can hardly be permitted to help himself or be held responsible for properly caring for materials. In the case of all storage space, therefore, much study has been given to designing each unit for a definite purpose. All storage cabinets were carefully drawn to scale and specifications were submitted for each piece. The result is that in most instances adequate, proper, and efficient storage space exists for all materials available in the arts workshop.

Earlier in this article, mention was made of the fact that only as pupils have freedom to select individual problems, to secure help when and from what sources needed, and to have adequate materials available for ready use at all times, is creative work encouraged. This fact should again be recalled in terms of the many and properly stored materials for use by pupils.

Hardware cabinets and tool boards are located on the two ventilating shafts running through the industrial-arts area. Storage space for pupils' projects is located under the workbenches. Metal wall and floor cabinets are located in the finishing room and the large storeroom for extra supplies, precision tools, and other less frequently used equipment. A specially designed lumber rack makes access to the main lumber supply convenient. Although the blower for the dust-collecting system is located under a specially designed bench, this bench also has extra space usable for storage. The Keene's cement bench is self-contained in that it stores all supplies and equipment. Foundry sand storage is provided by a bin designed for the purpose. Foundry metals are stored in boxes. The elementary grade industrial-arts tools are stored in the workbench designed to meet the needs of elementary grade pupils. Photographic materials and equipment are stored in cabinets designed for convenience of use. Storage space for paper, illustrative materials and general reference materials, also are provided. The library is equipped with book and magazine racks for the proper care of library materials.

Around the rooms of the ceramics, crafts, studio, living-room, and kitchen centers will be noticed extensive cabinetwork. A cabinet has been provided in which beads and leather supplies are stored to make them always available to the pupils. A separate cabinet provides storage for leather stock. Special cabinets for raffia, looms, paints, and the like may be seen in various views of the different art workshop centers. The larger general storage centers located in the different areas, are not shown on any of the illustrations.

The limited number of pictures presented in this article will give some idea of how carefully and efficiently storage space for both materials and equipment has been planned and provided. Although its cost is somewhat in excess of the cost of one large storage center, it can readily be seen that, in the type of program sponsored by the arts workshop, the type of storage used is most essential.

Equipment

As in the case of materials, the philosophy of the arts workshop specifies the supplying of a great variety of equipment. Unless adequate provision is made for hand and power tools, the pupil will be hampered in meeting the needs of the individual problem he selects, in being stimulated in creative effort, in adequately expressing himself, and most essential of all, he will be limited in the integration of his personality.

Proper kinds and amounts of equipment aid rather than hamper the pupil in his manner of attack on the problem. When just the right amount of equipment is installed, pupils are helped to develop socially. Too much equipment hampers this process. Not quite enough equipment to supply everyone needing it stimulates careful planning for the use of equipment and encourages cooperation of sharing of the use of equipment.

Pupils may tend to become more sensitive to surroundings, to the appeal of color and

form, and to the adequacy of the type of equipment in terms of its use when equipment is carefully chosen in terms of accepted practice and needs.

Every effort has been made to select standard equipment. Small and average-sized power equipment has been selected to replace heavier pieces whenever such equipment could be used properly to demonstrate accepted practice and at the same time meet pupil needs.

Use of the Plant

The basic emphasis of work in the arts workshop is general education. This implies use of any or all facilities by both boys and girls. No restrictions regarding participation are set up for members of either sex. Boys and girls from the kindergarten through the twelfth grade are permitted to avail themselves of all arts workshop offerings. Regular classes, of both boys and girls, are scheduled for grades seven through twelve.

To help establish some continuity to the whole program, the philosophy provides for enrichment experiences presented through a *general program* participated in by all members of each arts-workshop class. The general program is planned to develop an appreciation and understanding of both the early and contemporary arts. This general program also provides for a background of information regarding design and materials. Leisure time and consumer knowledge is a part of the same program. Group meetings, educational tours, visual aids, exhibits, demonstrations, and lectures provide basic methods for the presentation of the information. Pupil participation and planning are encouraged in determining the direction which the instruction in the general program shall take.

Elementary grade pupils as individuals, or as groups, are welcome at any time the arts workshop may be of service in the solution of problems. A full-time art program is now available for the grades. One-third time of one industrial-arts teacher is also at present available to the elementary grades.

Provisions for observation and participation are made for college students. A number of college classes are regularly held in the arts workshop.

Boy Scouts and Girl Scouts frequently avail themselves of the arts workshop facilities.

The industrial-arts area also sponsors a photographic club open to the entire student body and faculty.

The crafts area is used regularly for a project carried on by the organization of the American Association of University Women.

The facilities of the arts workshop have been opened to patrons of the school community who may wish to acquaint themselves with materials and processes made available. It is hoped that when the present program is well established that it may be offered to both parents and children at the same time so that dad and son, mother and daughter, dad and daughter, or mother and son may enjoy working together.

Evaluation of the Plant

After a philosophy and a plant are carefully developed and the program is put into operation one begins to ask questions. Does the plant actually meet the specifications set up by the philosophy? Can the program, as determined by the philosophy, actually be carried out in the resultant plant? In an effort to answer these questions an evaluation of the plant was attempted.

The short period of time during which the arts workshop has been in operation sets limitations for its evaluation. Orienting pupils and teachers to a new plant leaves much to be desired in the way of normal school procedures. Evaluations, therefore, presenting the ultimate in objectivity are necessarily somewhat wanting.

The problem presented itself of selecting an evaluating technique which would approach an acceptable degree of objectivity and by which an evaluation could be made immediately. The technique decided upon was that of the check list, chosen because it is not so costly and time consuming as personal interview or observation.

Since the accepted philosophy helped to guide procedures of plant planning and construction and since it also serves as a guide for class procedures in the arts workshop, the 22 points of view contained in the philosophy were set up as principles to be attained by the arts workshop plant, and appear in the check list.[3] Under each principle of philosophy were listed the present practices of the arts workshop faculty in use in the plant and what it eventually hopes to do to make the philosophy function in the arts workshop. It was felt that if these practices, called "means," could achieve the points of philosophy, the arts workshop plant would be adequate for the purpose for which it had been developed.

After all possible means were listed, the items were carefully restated and presented

Principle

1. The Arts should introduce the child to the heritage of his own race and that of the world.

Means for Realizing This Principle

a) By providing for many centers, representing such materials as clay, leather, textile materials, graphic arts, foods, clothing, and building materials.

b) By providing for the study of these materials beyond the point only of construction.

c) By providing for the securing of aid from other subject areas within the school.

d) By providing for the securing of aid from such sources outside of the school as the community and immediate environs may have to offer.

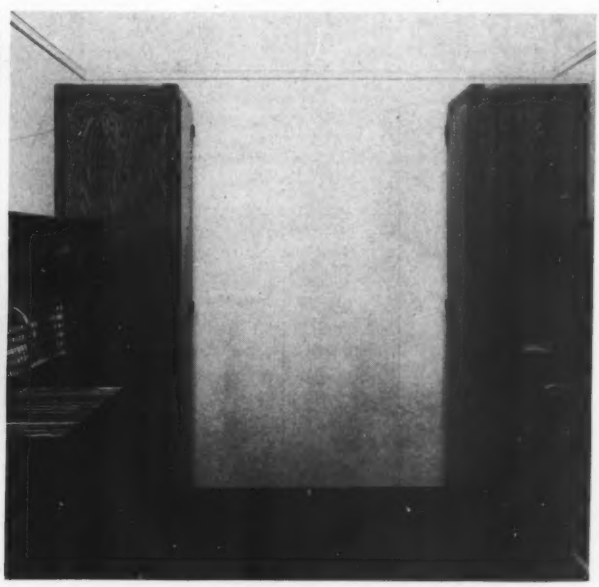
e) By pointing out relationships between materials, processes, and products of the older culture and of our culture today.

f) By providing adequate materials and equipment for worth-while arts experiences of older cultures.

g) By providing an exhibits center for the display of articles and information related to older cultures.

[3]The Principle of Philosophy 1 and its resultant "means," as found in the original check list, are here recorded, and serve as a sample of the check list content.

Wood Center, looking into west end of metal



East end of Photographic Center

for evaluation to the four faculty members of the arts workshop. These evaluations were made in terms of "this means does provide adequately for carrying out the principle of philosophy" or "this means does not provide adequately for carrying out the principle of philosophy." Responses were registered in terms of checks to be placed in either a *yes* or a *no* column. Each instructor evaluated the group of means appearing under a principle in accordance with the foregoing statements. After the means had thus been evaluated, items in each group were ranked in terms of which means appeared to be most important, second in importance, and third in importance, until all means had been ranked. The procedure was followed for each of the 22 principles by each of the four instructors. Provision was also made at the close of each group of means appearing under each principle of philosophy for any additions the instructors cared to make. Their criticisms of any means were solicited, and many notes appeared in the margins of the check lists. Returns from the four check lists were tabulated, and the tabulations studied of needed revisions to be made.

The presentation of the original check list to members of the arts workshop faculty was an attempt to establish the validity of the check list. This procedure helped the writer to decide whether the means represent present practice plus plans which were expected to be incorporated in the program, and for which the faculty feels adequate provision has been made in the plant.

The individuals chosen to evaluate the final refined check list are recognized as leaders in their fields and are known by or were recommended by faculty members of the arts workshop and the principal of the Burris Laboratory School. These individuals represent the fields of administration, art, household arts, and industrial arts. The individuals to whom check lists, floor plans, and explanatory notes regarding the program were mailed represent a broad geographical distribution and stand for many different points of view regarding the arts. No individual receiving a check list was in any way associated with the arts workshop.

Replies were received from 113 of the 216 (52.3 per cent) who were asked to cooperate in the study. These replies represent a broad geographical distribution. Of the total number responding, 27 were from the administrative field, 27 from the art field, 25 from the household-arts field, and 34 from the industrial-arts field.

It was the specific purpose of the check list to answer the question: Does the Burris Arts Workshop plant make adequate provision for the proper functioning of the philosophy which governed the development of the arts workshop? Judgments were sought in terms of individual *means* and in terms of whether or not the group of *means* appearing under each principle adequately provides for its proper functioning.

Through affirmative judgments received from those returning the check lists, certain conclusions have been reached as to the adequacy of the provision made by the arts workshop for the functioning of the philosophy which governed its planning, construction, and equipment.

The high percentage of affirmative judgments indicated that the judges feel that in all but the case of Principle of Philosophy 8, the *means* appearing under the respective principles of philosophy do provide adequately for the points of philosophy stated in the principles. The high affirmative judgments would also indicate that since the *means* are provided for by plant and method, the arts workshop would in turn provide for the adequate functioning of the principle of philosophy.

The spread of total judgments for Principle of Philosophy 8 indicated that there is some question in the minds of the judges as to whether or not the arts workshop makes very adequate provision for informing pupils of present social and economic problems. The comments accompanying the judgments indicated that the judges feel since the social sciences already emphasize this principle of philosophy the arts workshop should not duplicate the work by also making provision for social science content.

New General Industrial-Arts Shop

EDWIN E. NIHISER*

The State Normal School, Brockport, N. Y., has recently finished a new plant at a cost of about $1,250,000. Contained in this plant is our shop department which has been considerably enlarged. There are seven rooms in the whole unit: the main shop, finishing room, storage room, stockroom, inner and outer office, and conference room.

The shop is arranged so that the instructor may observe workers from almost any position. Students work mostly at long wall benches and face the wall. This arrangement keeps the middle areas of the shop comparatively clear.

Noise is kept at a minimum by the use of acoustical ceilings and the mounting of all benches and machines on live rubber.

The department is practically fireproof with the use of steel cabinets and shelving, steel partitions and general cement construction.

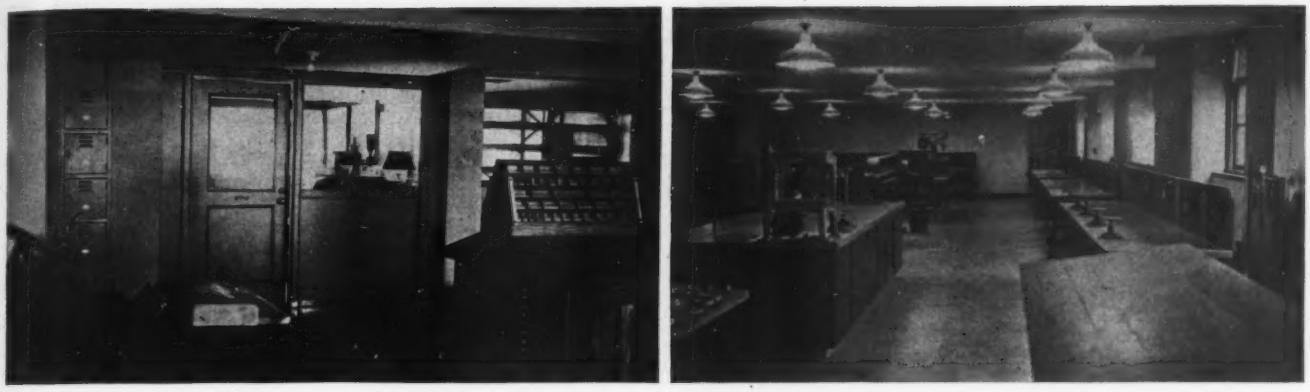
As the general shop is used for the teaching of groups ranging from grades V and VI, up to college level, its design presented problems which are not met in planning a shop used by groups of smaller range.

The shop is designed to handle 11 basic units: art metal, ceramics, wrought iron, woodworking, electricity, mechanical drawing, wood turning, metal turning, metal spinning, textile weaving, and printing.

The actual work space for each of these

*Director, General Industrial Arts, State Normal School, Brockport, N. Y.

The ceramics unit and display racks in the corridor



Printing, drawing, electricity, and woodworking units

units has been kept as close to the outside walls as possible, thus leaving the central area free for more specialized machines such as: the jointer, shaper, wood band saw, metal band saw, grinder, metal-spinning lathe, machinist's lathe, squaring shears, circular saw, wood lathe, and sander. All of these machines are mounted on rubber to reduce noise and vibration to a minimum. The placing of these machines is a safety feature which reduces the interference with those operating machines requiring close attention. By this arrangement and by designing the instructor's office of glass panels such as are used in industry, it is possible for the instructor to have a clear view of all activities from his office. Those from which injury is most likely to occur are under closest watch. The instructor is free to remain in his office, shut off from any outside noise, to have conferences with students, and to do other work, yet able to see just what is going on in the shop and to be alert for any emergencies.

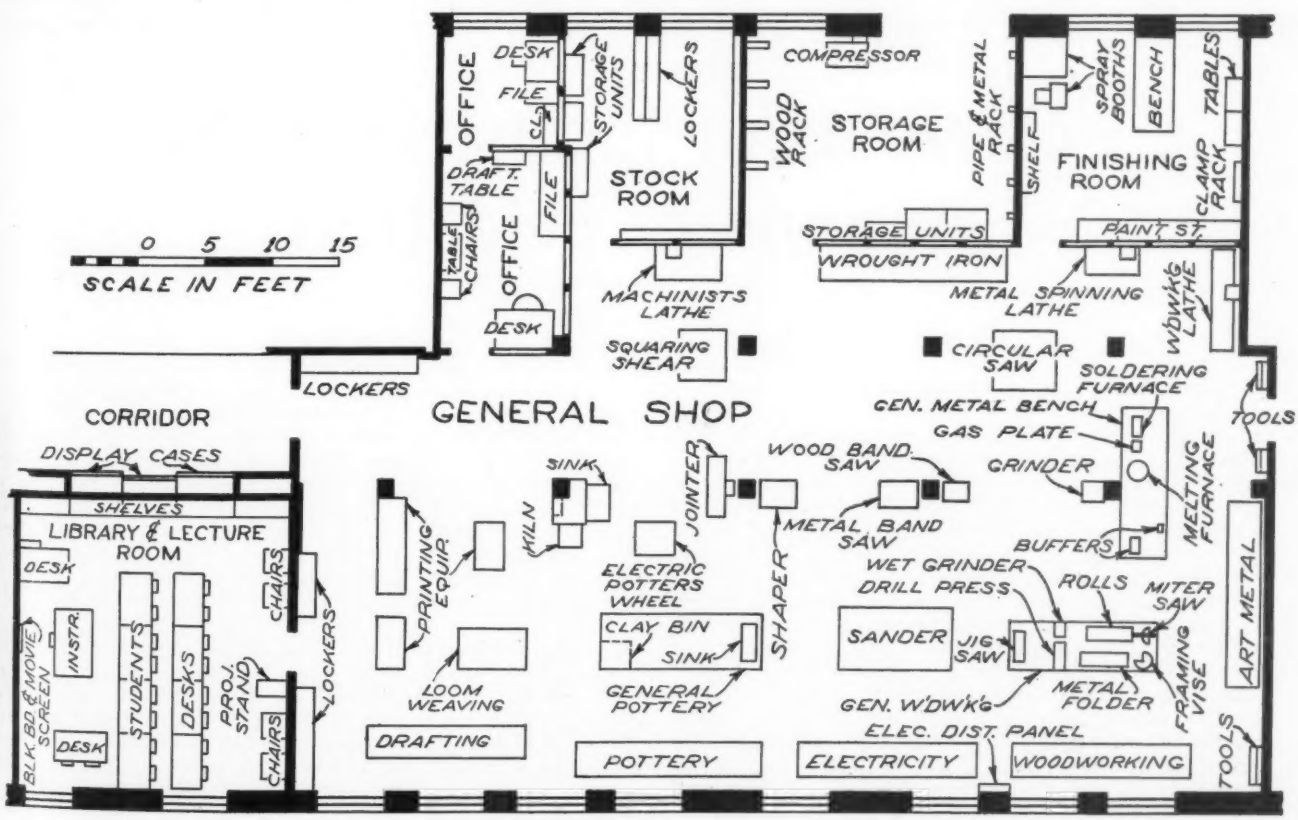
The shop is located close to the nurse's office which is never closed and has complete facilities for handling first-aid treatment.

To keep tools in orderly arrangement and out of the way of the workers, they are hung from pegs in metal cases, the doors of which open on hinges and wheels, thus making two surfaces upon which to hang tools, and also allowing the tools to be locked up when necessary. Each tool is hung on wood pegs against a black silhouette which shows immediately where a tool should be replaced or what tools are missing. These compact units are also placed against the walls to keep center areas open.

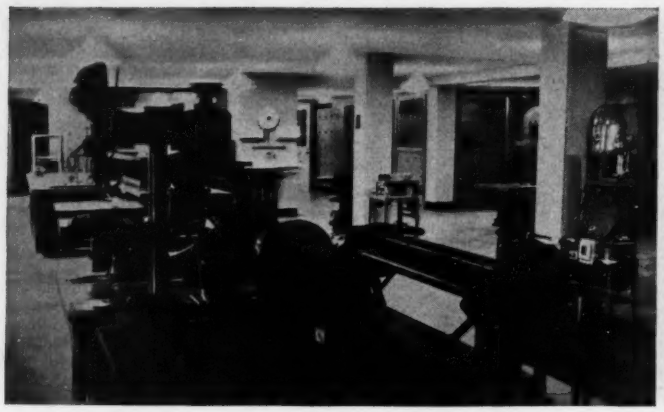
The electrical distribution panel, which was designed by the instructor, is very flexible allowing for both a.c. and d.c. current in any quantities for shop use or experimentation. The Variac which permits a.c. current from 0 to 135 volts is a feature of this board.

Compressed air is available at all key points throughout the shop.

The pottery unit was also designed specifically for this shop. As some classes meet only once a week it is necessary to have special cases in which partially completed models can be kept soft and workable by



General Industrial-Arts Shop, State Normal School, Brockport, N. Y.



Metalworking and art-metal centers

humidifiers. The stone tops of this cabinet provide additional bench space where glazing and decoration may be done. As part of this unit a stone clay bin has been built into one end of the cabinet. At the other end water is available. If potter's wheels were mounted on the top, this cabinet could be used as a complete ceramics unit with the exception of the firing kiln.

Although the emphasis is put on the hand method of pottery construction, an electric potter's wheel has been installed for use by the advanced students.

All equipment of each unit is grouped as closely together as possible, as can be seen from the plan. All ceramics material, for instance, is at the east end of the shop; all woodworking material is in a second area; and all printing material is in a third, etc. This reduces confusion and crowding of workmen to a minimum.

Another unique feature of this general shop is the folding blackboard mounted on the post between the windows facing the mechanical drawing unit. When not in use it folds inward to the width of the pillar, thus allowing more light to enter from the window.

All of the students' personal material as well as incomplete work is kept in individual combination lockers at the east end of the general shop.

Equipped with blackboards and desks, the library may be used as a lecture room. A rolled screen above the blackboard and special window shades allow instructional movies, some of which were made in the old shop, to be shown. Glassed-in cases, not needed to hold the 200 books, 125 pamphlets, and numerous periodicals of the library, are used as additional showcases for models.

The finishing room contains open shelves for drying and closed cabinets for all materials. A wall rack holds the clamps. Compressed-air outlets are available for spraying and a hooded electric fan removes all fumes from the spraying table.

The storage room houses the air compressor as well as the larger supplies. It is equipped with large doors to make the unloading of trucks directly into the shop convenient.

Additional lockers are available in the stock room which also contains an additional tool locker and open shelves along the walls for all smaller supplies.

Work which has been done in the shop is displayed in electric-lighted cabinets set in the corridor wall at the entrance to the shop.

Principles of Industrial-Arts Equipment Selection

ELROY W. BOLLINGER*

The obvious basis for industrial-arts equipment selection is the educational program which is to be achieved through its use. Cost, as such, is but a negative consideration at best and should be considered only after the program has been fully projected.

Each tool, each machine, each bench, and each piece of apparatus must provide for a maximum of pupil participation in its use. In other words, mere pressing of a button to perform an operation defeats learning. In addition to this, each item of equipment must represent a basic industrial process. It is only through an understanding of these processes and their effects that the pupil is enabled to interpret the infinite number of applications so characteristic of American life. Learning through experience for purposes of orientation in an industrial society requires a variety of equipment rather than a duplication of specialized items.

Safety is secondary only to educational criteria. This means that all equipment must be designed and built, and in turn selected and used, with specific reference to the size, height, strength, mental development, and experience of the individuals who are to use it. Thus the capacity, weight, power, speed, and size of machines for industrial-arts classes should be determined by the nature of the pupils who use them.

Obsolescence is also a factor which industrial-arts programs and school officials must learn to recognize and face. American industry *retools* periodically for a world where change is the only certainty. The school is faced by the same certainty. The equipment manufacturer is now producing less costly equipment of smarter design to encourage periodic replacement. But, the industrial-arts program of today finds itself equipped, in effect, with horses and buggies in an age of complex machine transportation. If American people want their children to cope successfully with such an age, then the lessons for equipment selection seem to be most plain.

The principles enumerated in this article were developed by the author and members of his laboratory planning class at Ohio State University, Columbus, Ohio.

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Functional Features

1. Machines should be of the unit type in order to provide maximum efficiency, safety, and flexibility of arrangement. Combining a circular saw, mortiser, and jointer into one machine reduces the usefulness and efficiency of each machine besides resulting in unnecessary interference and hazards.

2. Machines should be designed and used for only one type of work. The drill press, for

example, which is in such constant demand, should not be expected to serve as a router, a shaper, a sander, and a hollow-chisel mortiser in addition to its principal function of drilling.

3. Automatic feed and control devices obscuring the principles of a machine should be avoided for industrial-arts classes except for reasons of safety. Automatic feeds on mortising machines and drill presses, quick gear changes on lathes, and automatic press feeders are cases in point.

4. Machines should be mounted on individual bases, preferably enclosed on all sides to the floor to facilitate cleaning both machine and floor. A machine mounted on a bench destroys in part the usefulness of both bench and machine.

5. The equipment provided in a laboratory should be of a size or capacity which will take care of the bulk, but not necessarily all of the work which anyone would like to do. For example, there may be a distinct educational value in having a pupil himself take some work directly to an industrial shop or plant, where he will make new contacts, observe industrial methods, evaluate production costs, note merchandising procedures, and have the experience of being a customer.

Safety Features

6. Essential safety features such as circular-saw guards, jointer guards, pulley and belt guards, should be designed and supplied as an integral part of the equipment.

7. All moving parts of power-driven machines must be guarded or enclosed except those used directly in the operation involved.

8. All hand-operated machines that present hazards such as squaring shears, punch presses, paper cutters, etc., shall be provided with effective guards.

9. All moving parts of motor-driven equipment, whether guarded or not, should be free of projections such as setscrews, knobs, keys, etc.

10. Guards, when used, must be simple in design, positive in action, and interfere as little as possible with the operation of the machine. Guards that adjust themselves automatically to the work being done are to be preferred over manual types.

11. All grinding equipment should be provided with shields of laminated safety glass.

12. All motors should be equipped with overload protective devices of the thermanrelay or circuit-breaker type. These devices should be incorporated in the case with the motor-switch control.

13. The size, capacity, and power of any machine shall be determined with reference to the age, strength, height, and mentality of the pupils who are to operate it. It is questionable, for example, if any machine in a junior high school laboratory need be driven with a motor exceeding one horsepower.

Design Features

14. The average elbow height of individuals who are to use a bench or machine shall be the reference point in specifying the operation level of said bench or machine.

15. All machine tools should have individual motor drives, controls, and stands.

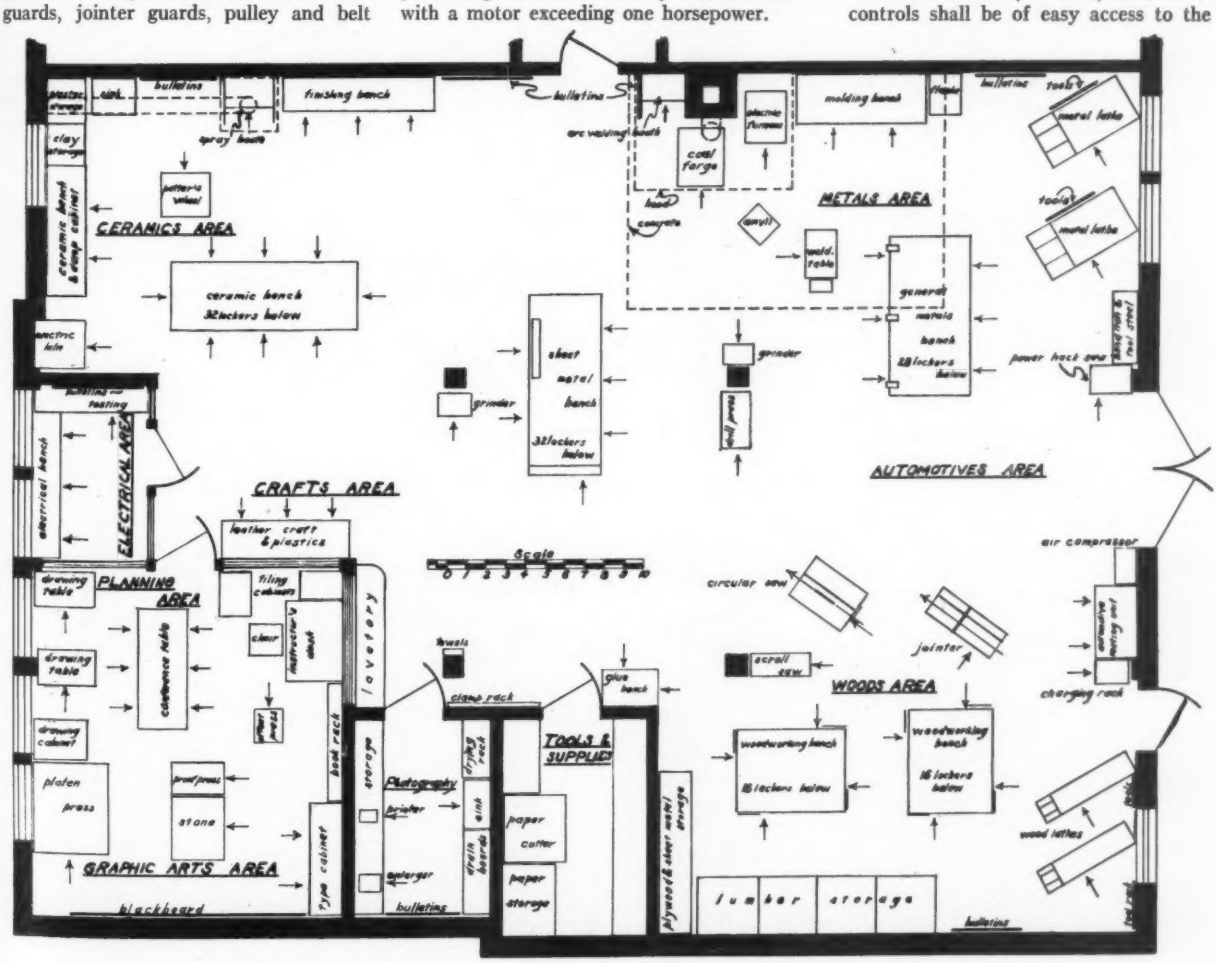
16. Power for any machine should be adequate to operate the equipment under its full rated capacity without unreasonable overloading of the motor.

17. V-type belts are usually to be preferred to flat belts from the standpoint of power transmission and general efficiency. Flat belts, if used, should be of the endless type and may be preferred as a protective measure because of slippage on excessive overloads. This is particularly true where machines may be locked by jamming, as in the case of an engine lathe or milling machine.

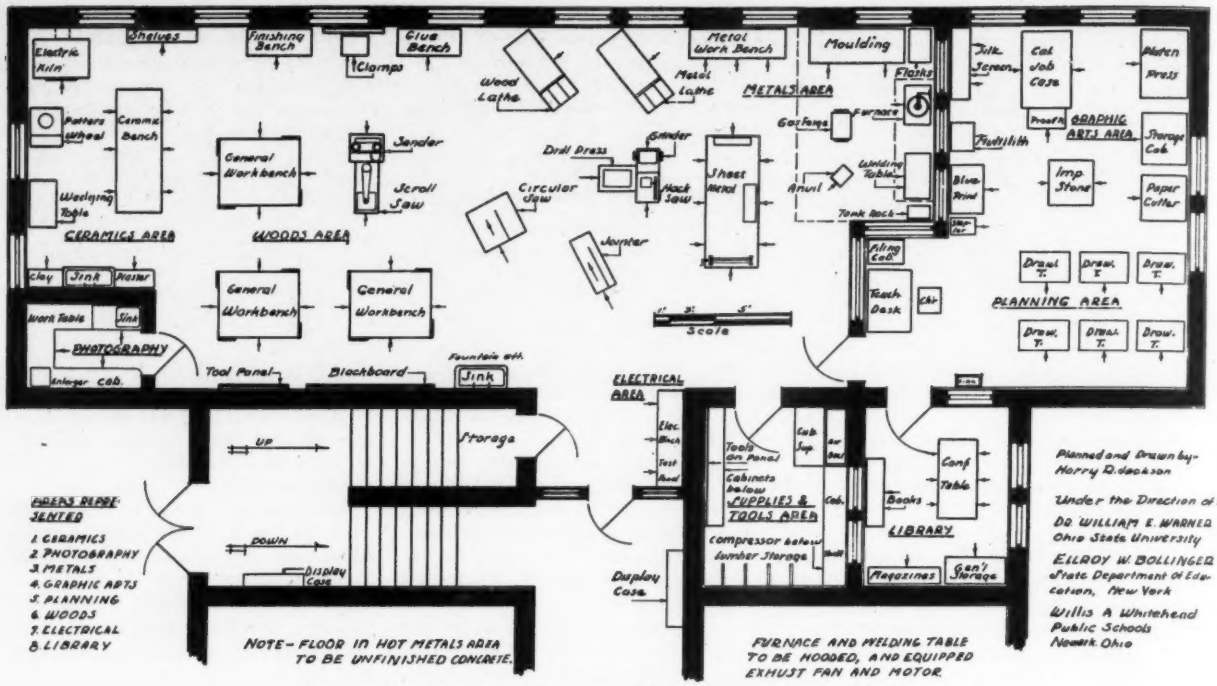
18. All reciprocating or revolving machine parts that work at high speeds should be balanced and counterbalanced to reduce vibration to a minimum.

19. Machine standards should be sturdy and rigid in order to provide a solid base free from weaving and twisting for the machine it supports. Cast-iron bases are usually superior in this respect and to be preferred over the assembled angle-iron type.

20. All handles, wheels, and mechanical controls shall be of easy access to the oper-



Laboratory of Industries, South Georgia Teachers' College, Collegeboro, Ga.



Arts and Industries Laboratory, Phelps Junior High School, State Teachers College, Winona, Minn.

ator, arranged not to interfere with each other, and be electroplated with an anticorrosive metal.

21. Speed controls should be convenient, safe, positive, and of a range sufficient for the work for which the machine was designed and the experience level of the operator; e.g., beginning printing-press operators require an unusually slow press speed.

22. The use of detached knobs, wrenches, etc., for adjusting and operating a machine should be avoided as far as possible.

23. Machine parts such as saw blades, drill spindles, mortiser bits, etc., should be easily and quickly adjusted and interchanged without damage to the parts.

24. Machines might well include housing space for extra parts and attachments that are used exclusively with that machine; e.g., wood-turning lathes should have some provision for holding the turning tools convenient to the operator and designed as an integral part of the machine.

25. Machine or cabinet bases shall not interfere with the movements or comfort of the operator; e.g., toe room shall be always considered in the design.

26. Machines shall be designed to allow the maximum amount of working space around the point of operation.

27. Power machines should be provided with switches placed within the operator's *natural* reach and vision while the machine is in operation but so located that accidental switching is avoided.

28. Motor-driven machines of one horsepower or less shall be equipped with a toggle or push-button-type switch operating in a vertical position and placed within natural reach of the operator.

29. The quality and kind of materials used in the construction of machines for school use shall be comparable to that used in machines for industry.

30. Sealed roller or ball bearings shall usually be considered preferable to other types of bearing.

31. Collectors for shavings, dust, etc., shall be an integral part of the machine. The machine shall, however, lend itself to installation of a central dust-collecting system.

32. Where possible, motors shall be housed within the machine, but made easily accessible for maintenance.

33. Flexible molded rubber power cords should be supplied and used in connection with all portable and semiportable equipment.

34. The need for periodic lubrication should be reduced to a minimum through such means as sealed bearings packed in grease or oil. Parts needing periodic lubrication should be fitted with snap-cover oil cups or alemite zerk fittings located for ease of identification and servicing.

35. Machines shall be designed to operate with a minimum noise factor and cushioned preferably with rubber mountings furnished as an integral part of the machine.

36. Machines embodying sheet-metal construction should be treated with a noise-absorbing or dampening medium glued or sprayed on inside metal surfaces.

37. Machines should be painted a distinctive color sufficiently light to have a light-reflection factor of at least 40, free from objectionable glare, easy to clean, and of neat appearance.

38. *Local* lighting incorporated as an integral part of machines is desirable.

39. Simplicity of construction and design and ease of maintenance shall be considered desirable in all equipment.

FLOOR AREAS AND EQUIPMENT IN SMALL HIGH SCHOOL SHOPS

DUANE CHAMBERLAIN*

The following report is a portion of a recent graduate study which surveyed shops in some 200 of Michigan's smaller high schools. None of the schools included in this report have enrollments over 500 in grades 7 through 12, and the large majority have school populations far below this figure. The study was made at the University of Michigan under the direction of Dr. George E. Myers.

Floor Areas. Data relative to floor space indicated considerable variation in the size of a school shop. The smallest shop had an area of 120 sq. ft. and the largest 4000 sq. ft. Five shops had floor areas of less than 200 sq. ft. Table I reveals the results of the study on floor areas in 167 shops.

*Michigan State Normal College, Ypsilanti, Mich.

TABLE I. Shop Floor Space

Area in Sq. Ft.	*Frequency*	*Per Cent*
0– 500	19	11.4
501–1000	65	38.9
1001–1500	40	23.9
1501–2000	26	15.6
2001–2500	7	4.2
2501–3000	5	3.0
3001–3500	2	1.2
3501–4000	3	1.8

Over one half (50.3 per cent) of the shops studied had floor space of less than 1000 sq. ft. Three foruths (74.2 per cent) of the shops studied had less than 1500 sq. ft. of floor space.

Value of Shop Equipment. Table II shows that over one third (38.7 per cent) of the 155 shops, which reported value of shop equipment, had equipment valued at $500 or less. Few shops reached the $2,000 mark.

TABLE II. Shop Equipment Value

Estimated Value	*Frequency*	*Per Cent*
1– 500	60	38.7
501–1000	43	27.7
1001–1500	18	11.6
1501–2000	21	13.6
2001 and above	13	8.4

This table also shows that most schools expended on equipment amounts in excess of the minimum set by "The Committee on General Shop,"[1] which is $335.46.

Extent and Kind of Power Machines. Four per cent of a total of 170 shops reported that no power machines were included in their equipment. Eighty-seven and seven tenths per cent of the shops had three or more power machines in their equipment. Table III shows that power machines are quite generally used in small shops, only seven reporting no power machines. On the other hand, fewer than half of these shops had five or more such machines.

TABLE III. Number of Power Machines

Number of Machines	*Frequency*	*Per-Cent*
0	7	4.1
1	10	5.9
2	14	8.2
3	31	18.2
4	30	17.6
5	30	17.6
6	20	11.8
7	15	8.8
8	4	2.4
9	5	2.9
10	4	2.4

[1]*Shop Work for Rural High Schools*, Bulletin No. 233, Lansing, Mich., the State Board of Control for Vocational Education, 1939, p. 23.

Table IV reveals the wood lathe, the grinder, and the circular saw to be most frequently included in small shop equipment.

TABLE IV. Kinds of Power Machines and the Frequency with Which They Are Used

Name of Machine	*Frequency*
Lathe — Wood turning	127
Grinder	124
Saw — Circular	114
Drill press	78
Jig saw	75
Band saw	56
Jointer	53
Sander	28
Machine lathe	16
Other machines	4

The types of machines used indicate that more emphasis is placed on machine woodwork than on machine metalwork. It is further evident that administrators of small schools recognize this as a machine age and believe machines necessary to meet educational objectives.

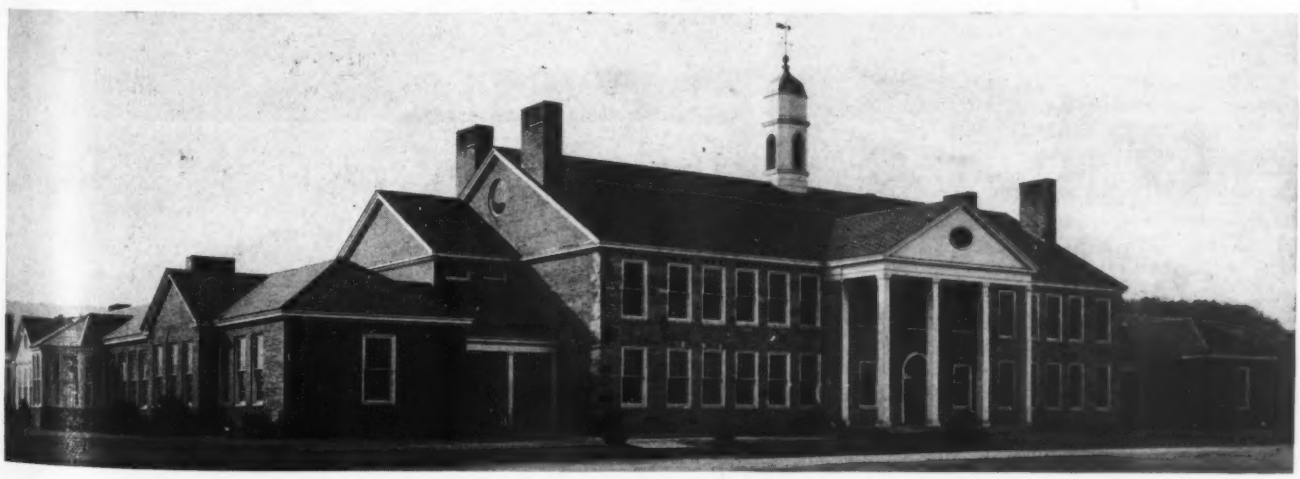
Industrial Arts at Connecticut's First Regional High School

WESLEY P. WINTER*

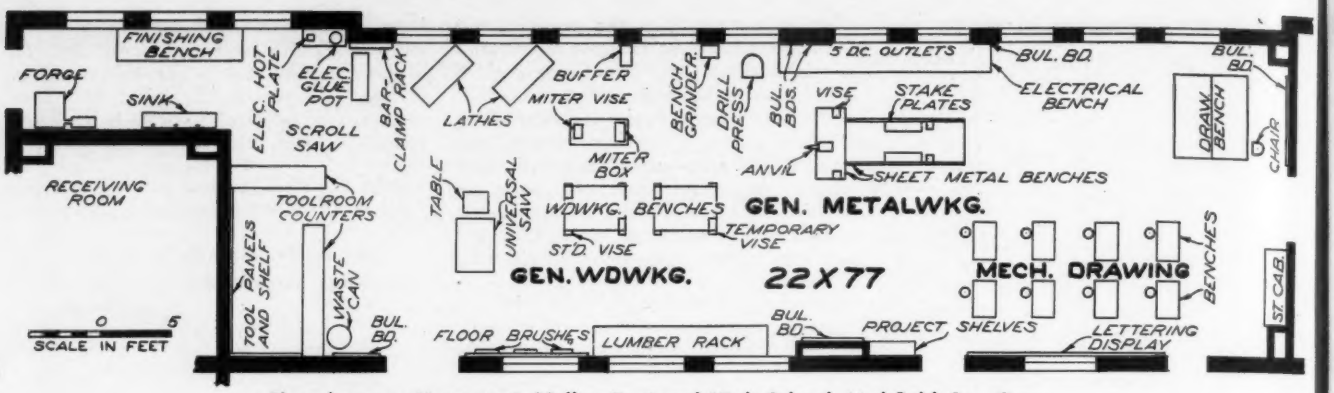
One of the chief factors that affects inclusion of industrial arts in any school curriculum is the apparent high expense. The small high school finds it difficult, if not impossible, to include even a general shop with any degree of extensive equipment. Were it not for the Housatonic Valley Regional High School, the first of its kind in New England, the high school age students in six northwestern towns of Connecticut would still be attending classes in four small high schools offering but three courses of study. None of these schools found it possible to offer practical subjects such as industrial arts. With the opening of the Housatonic Valley Regional High School in 1939, however, the curriculum was broadened to include six courses and four new departments, one of these being industrial arts.

*Instructor of Industrial Arts, The Housatonic Valley Regional High School, Litchfield County, Conn.

Before discussing in detail the industrial-arts department, a brief history of this school may be of interest. Thought was first given to such a project about 19 years ago, but nothing definite took place until June, 1937, when a special bill creating the Regional High School District Number One of Litchfield County was passed. In October of the same year, each of the six towns, namely, Canaan, Cornwall, Kent, North Canaan, Salisbury, and Sharon, gave their approval to the new project. Soon after this action, the Regional



The Housatonic Valley Regional High School



Shop layouts, Housatonic Valley Regional High School, Litchfield Co., Conn.

High School Board was formally organized, each town, regardless of size, having but one representative. Each member is elected by the local board of education, but need not necessarily be a member of that group. While each town has equal representation on the board, the cost of operating the school is not shared equally. The annual school budget is divided among the six towns on the basis of the average daily attendance of pupils during the past year. This ranges from 29 per cent, paid by Salisbury, to 4 per cent paid by Canaan.

The site chosen for the school was a 75-acre farm one mile south of Falls Village along the banks of the Housatonic River. Ground was broken in October, 1938, and work progressed until the new school opened on September 25, 1939, to admit a group of 384 pupils. These pupils, representing families of many kinds — farmers, merchants, professional men, industrial workers, and day laborers — travel daily by buses to this spacious school which serves an area totaling 277 square miles.

The Shop

The shop, a large room 22 by 74 ft., is located on the west side of the building. Large windows on one complete side serve to admit ample daylight. There are 15 standard RLM reflectors well placed to provide excellent artificial lighting when necessary. As in many of the other classrooms, the brick walls blend well with the woodwork of soft Williamsburg green and a composition inlaid floor. The present layout of this shop is shown in Figure 1. Three areas of work are provided, and equipment is organized to conduct classes on this basis. Future expansion of the department is planned by the utilization of an adjoining room for art and mechanical drawing, adding graphic arts in the space thus relieved. In addition, tentative plans are being formulated for the extension of existing areas when possible. A space now occupied by a finishing bench is reserved for a forge and small foundry. A special room leading off the display balcony in the adjoining room is being fitted as a blueprinting darkroom. Prominent among possible changes is the tentative plan for a branch library to be located on the display balcony where books relating to industrial arts and home economics may be placed.

Particular attention is called to the toolroom. In the design for the shop, no especial provision had been made for the storage of tools. It was felt that a wood slat or wire cage structure would mar the appearance of the room, yet there was insufficient wall space for the newer tool panel idea for dispensing tools. Since the present instructor prefers the type of toolroom which requires a student clerk, the counter idea was chosen as the most practical to install in this type of shop.

The counters, as well as many of the machine benches, were designed by the instructor and built by the advanced industrial-arts students. The care and enthusiasm with which they went about this work proved the value of the training they were getting. The construction of the counters is so designed, that the units are readily moved for possible changes in the layout, and yet form an extremely solid and generally useful bench or work surface. Oak flooring constitutes the top surface with a 2 by 6-in. foundation firmly mounted on 2 by 4-in. legs and braces. White pine facing, 1 by 8 in., and plywood panels finish off the outside. Shelves and drawers have been added inside to increase the strength and utility of each unit. This construction is simple and yet firm, and is considerably less expensive than ready-built metal counters and benches. Although not yet complete in some minor details, they are to be finished with maple stain and shellac, the latter being chosen to eliminate the high gloss of varnish, and to make it easier to renew after scuffing. The toolroom counters and benches thus constructed have been in use since September and have proved satisfactory.

Organization and Management

When possible, classes are arranged on the double-period basis, five days a week. Periods are 45 minutes long and full credit is given for the satisfactory completion of certain required jobs. Time is available for individually selected jobs to round out the experiences of

Mechanical drawing area and toolroom

the student. In all classes the care and storage of tools and materials is turned over as much as possible to student clerks. These clerks are assigned in alphabetical order from the class roster posted on a special bulletin board. Clerks remain on the job for one week at a time, and their duties are carefully outlined. Selected from the entire class is a toolroom clerk who is charged with the responsibility of handing out equipment kept in the tool area and receiving the returned items for proper storage. Labels are used as much as possible to show where things belong, and a conscientious clerk learns correct names of tools as well as acquiring the habit of orderliness. Besides tools, such materials as hardware, some finishing materials — notably sandpaper, steel wool, large supplies of shellac, paint, varnish, new rags, and the like are kept in the toolroom, and the clerk in charge also handles these things. Thus he learns correct specifications for these items. As soon as practical, a check system will be instituted, further increasing the training he gets and providing a more rapid countercheck by the instructor.

In each area of work a foreman, chief sweeper, and sweeper are appointed. The foreman is the "boss," checking on the work of the others and assisting them when necessary. Any materials or tools left out of place are returned by the foreman. The chief sweeper has charge of cleaning benches and machines in his area and he assists the sweeper with the floor. In addition, a safety engineer is appointed in rotation from the entire class to see that guards are in place and dangerous items are removed or reported. When necessary he also takes the place of an absentee clerk.

This arrangement relieves the instructor of many routine responsibilities and permits more real teaching of principles and processes. It also helps make possible the use of a rather extensive perpetual inventory system and progress charts. The progress charts are made out for each class, and posted for students to watch. They are the accepted form, with job and assignments listed at the top and students' names on the left-hand side. Grades are posted daily or at the completion of a job, and the student may readily see his standing in comparison with his fellow classmates.

The perpetual inventory, which is kept in loose-leaf notebooks, is divided into three sections; namely, inventory of materials, inventory of small tools, and inventory of machines. Included with machines is the special equipment, such as saw clamps, miter vises, benches, and the gluepot. Space is provided for all pertinent information concerning purchases of the various items, replacements, new attachments, repairs, and what disposition has been made of items that were discarded. While the system involves considerable bookkeeping, it is practical in its completeness and value. It has proved to be, in the past, of inestimable value for determining quantities to be ordered for an ensuing year; it provides a complete check of expenditures; it shows where every cent of the allotted money has gone when supervisors and others want a quick check; and finally it is a system students can use for determining project costs when necessary.

The Course Work

The trend in the elementary grades of the several small towns represented is toward industrial arts. Several of the schools already devote time to this work and several others are contemplating its inclusion in the near future. This fact materially affects the attitudes and abilities of the students selecting the subject in the high school. Of more importance is the fact that a wider variety of activities can be included on the higher level without robbing the boy of pleasant elementary experiences in the more common branches of the work.

The industrial-arts course in the high school is organized on a general shop basis. Areas have been established in mechanical drawing, general woodworking, and general metalworking with the possibility of an area in graphic arts to be added when the demand is sufficient. Within each area the work is further broken down so that as many different units or trades as possible are represented. This breakdown is not yet complete, but it follows a definite plan. The following outline presents the setup in a brief form.

A. Mechanical Drawing

1. *Sketching:* Since students are required in all areas to produce a readable sketch of projects they select, this phase of drawing re-

JOB CARD

Regional High School — General Shop

Name	Project	Date Started	Date Finished	Period

Name of Part	Kind of Wood	No. of Pcs.	Rough Size T	W	L	Fin. Size T	W	L	Quan.	Unit Cost	Total Cost

ceives considerable attention. It is, however, worked in with instruction in projection drawing.

2. *Projection Drawing:* The accepted forms of orthographic, oblique, and perspective projection are studied. Orthographic projection in the form of two- and three-view working drawings, auxiliary views, sectioning, and some isometric drawings, constitute the required work of the first and second-year students. More advanced and detailed work, tracing, and simple blueprinting, is available for those desiring such training, while others receive less detailed instruction and demonstration of such work.

3. *Sheet-metal Development:* This phase of the subject is required of second-year students and further presented to advanced students by means of projects requiring its use. As an example of such a problem, advanced students are soon to begin planning a hood for a secondhand forge to be installed in the vocational-agriculture repair shop.

4. *Architectural Drawing:* Since the immediate use of a knowledge of architectural drawing and the gaining of immediate experience in this work are limited, it is reserved as an optional phase for advanced students, along with elementary topographic work and graphic charts.

B. General Woodworking

1. *Cabinetmaking:* This form of woodworking receives the most attention. Projects classed in this work are required of first- and second-year students. The work progresses in difficulty as experience is gained and culminates in optional work by third- and fourth-year students. Duplicated drawings are supplied by the instructor for required projects, and students are required to keep individual records of each project on a form supplied. As needed, instruction and information concerning related topics such as the manufacture and use of woodworking abrasives, and cost calculation, are included with this work.

2. *Woodturning:* This work is planned on the group-project basis. Plans for this year are based on a croquet set with first-year students turning the mallet heads, handles, and stakes, and more advanced students turning the balls. In addition, special turning jobs are encouraged, although not required, and the lathes are in constant use.

3. *Carpentry:* As a special subdivision of woodworking, carpentry is based largely on whatever outside jobs are available. As an example, special portable bleacher units were recently constructed for use by the athletic department. Since such work affects a small portion of the advanced class, plans for the near future call for the construction of model houses to scale.

4. *Wood Patternmaking:* As soon as a foundry unit is begun as part of the general metalworking area, patternmaking will be used to help correlate the two areas and present a new trade unit in woodworking. This work will be confined to simple practice patterns which illustrate standard procedures, and patterns of useful metal projects that can be cast easily. No pattern will be made that cannot be used either for practice work or project work in the foundry.

C. General Metalworking

1. *Sheet-Metal Work:* Simple useful projects selected from a variety of references serve to provide experiences in this form of general metalwork. Many of the projects are selected for their use around the shop for the storage of hardware, while others are intended for use at home and thus are of interest to the individual student. As wide a variety of materials as is practical is used, and different methods of fastening sheet metal are included. Related material presented, covers cost, layout, manufacture of materials, and standard procedures. At present no sheet-metal forming equipment is available, but future plans call for its addition just as soon as various items can be obtained. When new materials are no longer available, tin-can work which at present is optional will be substituted.

2. *Bench Metalwork:* This term is used to describe work involving bars and rods of mild steel and heavy sheet iron. Strictly useful projects constitute the work, and considerable individual selection prevails. Projects requiring wood parts, such as handles, serve to correlate other areas since students are encouraged to make their own. This work is required in first year only, but a variety of designs are available as optional work for more advanced students.

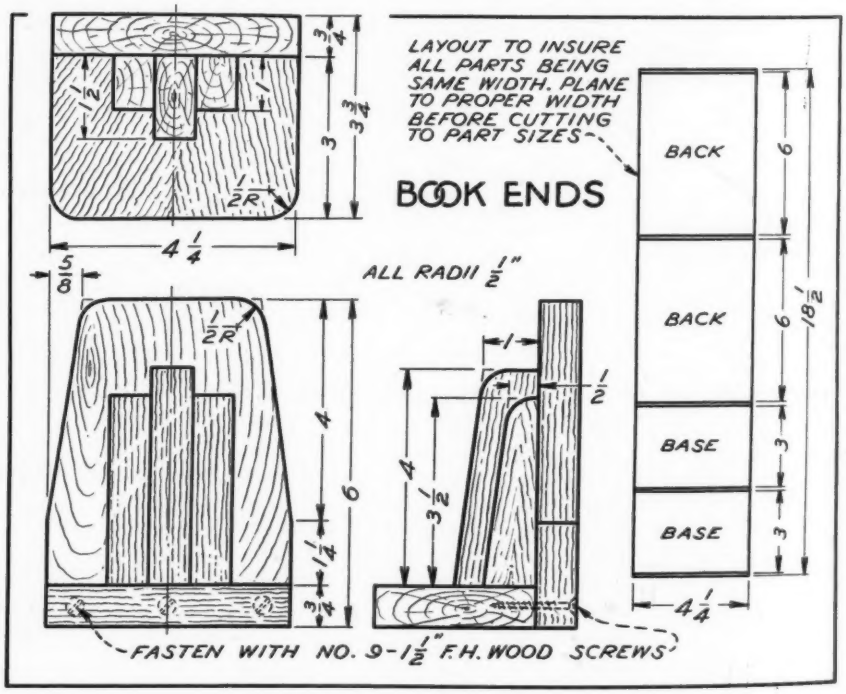
3. *Wrought Ironwork:* While closely related to bench metalwork in many respects, wrought ironwork is separated primarily for the procedures involved. Required in second-year work, suggested projects include brackets, Christmas-tree stands, and furniture items. Various sizes of strap or band iron constitute the material used.

4. *Art-Metal Work:* When available, sheet copper, brass, and similar materials as well as bars and rods are used in this work. Hammered work and projects assembled with copper rivets and solder prevail. One special job planned is based on the group-project idea where various students in one class construct different parts of a desk set, using the same decorations throughout. When proper materials are no longer available, several subdivisions of the metalwork area are to be combined and plastic work substituted. This will open up a new field for the students, and will be continued after art-metal materials again become available.

5. *Foundry Practice:* Metals with low melting points cast well in a fine sand. This fact permits teaching of standard procedures while the students make paperweights, ash trays, book ends, and similar projects that can be formed by casting. Advanced woodworking students construct much of the equipment needed. While not yet begun, definite plans call for foundry practice by the end of this year. The present instructor has had successful experience along this line.

6. *Electricity:* One of the features included when the high school was built enables this work to be more useful. A bench with five d.c. outlets, as well as a.c. outlets on the wall, make it possible to perform many experiments successfully. More extensive work is being planned based on a study of sources, control, measuring, and use of electricity, with practice wiring jobs prevailing for the beginner, and actual wiring jobs when available, for the more advanced student. The first job of this kind to be completed this year was the addition of lights in a small storage room leading off the display balcony in an adjoining room that is being converted for use in blueprinting.

7. *Metal Spinning:* Reserved for advanced students in general metalworking, spinning of


LAYOUT TO INSURE ALL PARTS BEING SAME WIDTH. PLANE TO PROPER WIDTH BEFORE CUTTING TO PART SIZES
BOOK ENDS
ALL RADII 1/2"
BACK
BACK
BASE
BASE
4 1/4
FASTEN WITH NO. 9-1 1/2" F.H. WOOD SCREWS

Sample of first-year required project

copper projects is proving to be extremely popular. It has been found that many small pieces not particularly useful in other ways serve to demonstrate this art, although it confines the selection to small projects. This work is to be developed just as rapidly as possible in the years to come.

An industrial-arts department isolated too much from other departments tends to destroy some values which should be inherently present. In the regional high school this tendency does not exist. Vocational-agriculture students spend a portion of their time in the shop, under the direction of their instructor, working on special projects involved in their work. Tools and equipment are thus available for both groups, and purchases of new equipment are planned with this in mind. The storage of tools for both departments is combined with appropriate identification, effected by stamping each piece with steel letters. The secondhand forge now in the shop, being conditioned by industrial-arts students, will eventually be moved to the agricultural shop located in a barn. It will be available for both departments, and the space so relieved will be used for melting furnaces necessary for the foundry work.

Another and more extensive correlation project is already in the intermediate stages of development. The first floor of the farmhouse included in the purchase of the school property was turned over to the head custodian for living quarters, while the second floor was given to the home-economics department to be redecorated and used as a practice house. Nothing much was done on this project until this year, since preliminary training in cooking, sewing, and other phases of the subject had to be first completed by a group of girls. With the organization of a class in third-year home economics, however, progress on this project began, and the third-year industrial-arts boys were called upon to assist. In order to make the house usable in this way, considerable work had to be done. Among necessary changes were the installation of additional plumbing for bathroom and kitchen, installation of additional lighting, papering, painting, and various minor repair jobs. The industrial-arts department has been spending considerable time in helping to plan and execute much of this change. Boys have been assigned as plumbers, electricians, plasterers, designers, and carpenters, each assigned to a particular problem and supervised by instructors and local licensed contractors. Early in the work it was necessary to remove one wall to enlarge the kitchen, and the plastering thus required was done by the boys. Several boys are at present planning and constructing the kitchen sink and cupboard units, and, in the future, additions to the furnishings, as well as repairs, will be handled by the advanced industrial-arts boys.

This project naturally affords training for present classes that future classes may not have, but other outside jobs will be forthcoming. Among these are requests for tables, bookcases, and other items from teachers and several of the local schools. One school, extending its kindergarten, has ordered tables and painting easels, several of which are completed, and when possible the model house construction mentioned with the carpentry unit will provide the balance.

While there is still much to be achieved in this department, great progress has been made in the past three years. Especially in these times when skilled workers are a vital necessity to the welfare of our country it is the hope that in some small way this training will prove valuable to the boys of the Housatonic Valley Regional High School.

Miscellaneous

State Supervision of Industrial-Arts Education

WILLIAM J. MICHEELS*

Industrial-arts teachers desire more help from their state supervisory agencies, and educators throughout the country believe that more assistance should be accorded them. These general statements are borne out in a recent study made by the writer[1] and summarized in this series of articles.

There is little uniformity from state to state in the type of supervisory assistance given industrial-arts teachers. Only two states of the Union have supervisory officials whose sole duties concern the field of industrial arts, although other states are introducing such services or thinking seriously of moving in this direction.

Some teachers commend the efforts of their state supervisors; many more are critical of the program; and nearly all are agreed that a definite need exists for an extension of the services which state supervisors are able to give. These are among the numerous findings of this nation-wide survey which is described and discussed in the following paragraphs.

Beginnings of State Supervision

Public education is a function of the state.[2] By reason of this fact the State Legislature has plenary powers over education.[3] It (the legislature) "has the authority to determine the nature of the machinery to be used in administering education in the state and local units,"[4] and the usual procedure has been to delegate this authority to the state departments of education. State departments of education as we know them today are, generally, a product of the twentieth century. According to Schrammel the states that had such departments in 1890 usually had staffs of only two or three members, with only four states having specialized supervisory officials.[5]

The major functions of the earlier state departments of education were threefold: to gather statistics, to publish these statistics, and to stimulate public interest in education. These tasks were generally assigned to the departments and usually constituted the limit of their powers.[6] Since 1905 there has been a rapid expansion of both specialized functions and personnel. A study by Chambers revealed that "states have been little disposed to follow the example or lead of other states in the pattern of a state organization. Each state has evolved a department suited to its own tradi-

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[1]William J. Micheels, "State Supervision of Industrial Arts Education," Unpublished Doctor's Thesis, University of Minnesota, June, 1941, pp. xii–326.

[2]This function is reserved to the several states through Implication, by Article X of the Amendments to the Constitution of the United States.

[3]Lee O. Garber, *Education As a Function of the State*, p. 27 (Minneapolis, Minn.: Educational Test Bureau, Inc.), 1934.

[4]*Ibid.*

[5]Henry E. Schrammel, *The Organization of State Departments of Education*, p. 64 (Columbus, Ohio: The Ohio State University Press), 1926.

[6]Payson Smith, "Current Organization Problems of State Departments of Education," *Educational Record*, XVIII (April, 1937), 172–81.

tions and conception."[7] It can be definitely stated, however, that there is a tendency in most of the states to make more and more use of the state departments of education in administering and supervising the scattered schools. As to the sizes of the departments, there is range today from the comprehensive service of New York, with a staff of well over 100, to that of several smaller states with only a few officials. According to Robe, "New York seems to be the only state which has covered all subject fields (supervision). Utah, alone, has a primary supervisor."[8]

The inspection of secondary schools by a state department of education had its inception in Indiana, in 1875, when, according to Henderson, the state board of education in that state provided for the inspection and supervision of such units.[9] Previous to that time the University of Michigan (1872) began inspecting the secondary schools from which the members of its freshmen classes were drawn.[10] For about 35 years there was no definite authorization as to the agency which should inspect the schools and the practices varied from state to state. Gradually, however, the duty of inspection passed into the hands of the state departments of education. The author comments on this duty as follows:

> Visitation by special inspectors connected with higher institutions brought out opposition and the period (1910) closed with a tendency to transfer inspection from university faculties to state departments and state boards of control.[11]

We learn from Vance that since that time, and continuing strongly to the present, less and less emphasis has been placed upon the "inspection" phases of state department of education activities. One means of ascertaining this trend has been to note the changes in official titles from "State High School Inspector" or "Inspector of Schools" to "High School Supervisor" and similar titles.[12] In certain instances even the title of "supervisor" is now challenged as not being proper in a semantic sense when describing the duties of such state officials. This position is well summarized in the following statement by Vance:

> We are changing our fundamental emphasis from inspection and accreditation to stimulation and improvement. In other words, our supervision of secondary schools is becoming less and less mechanical. . . . Standards, which always connote rigidity, are being supplemented by flexible criteria. . . . The supervisor has come to be looked upon as a helper and not as a critic or chronic fault finder. . . . Supervision is working with, and not working over, the teachers, principals, and superintendents with whom we come in contact.[13]

[7] M. M. Chambers, "Some Features of State Educational-Administrative Organization," *Educational Law and Administration*, IV (July, 1936), 91.

[8] Thurlow Scott Robe, "Staffs of State Education Departments," *American School Board Journal*, XCIX (October, 1939), 41–3.

[9] Joseph Lindsey Henderson, *Admission to College by Certificate*, p. 51. Contributions to Education, No. 50 (New York: Teachers College, Columbia University), 1912.

[10] *Ibid.*, p. 56.

[11] *Ibid.*, p. 96.

[12] R. R. Vance, "Evolving Concepts Affecting State High School Supervision," *Southern Association Quarterly*, IV (August, 1940), 200.

[13] *Ibid.*

Status in Vocational Education

While industrial-arts education is considered a part of general education, its inherent nature is such that many persons relate it directly to vocational education; in fact, the state vocational industrial supervisor often has supervisory duties in connection with the state program of industrial arts. Because such supervision is concerned, directly or indirectly, with industrial-arts education, it is interesting to review very synoptically the essence of work in this field.

Under Smith-Hughes regulations the province of Federal Government is that of "cooperating with the states." In this respect monies are appropriated to be administered by state boards for *vocational* education. In most of the states a division of vocational education has been created in the state department of public instruction (the one exception being the state of Wisconsin).[14] Of main interest for this report is the fact that every state has at least one state supervisor (and sometimes assistant or district supervisors), of trade and industrial education.

The functions of these state staffs for vocational education, as listed by the Advisory Committee on Education, are as follows:

1. To promote the development of new centers in which the program may be established.
2. To require reports from local centers and to compile the state's report to the federal office.
3. To visit and supervise the instruction in the centers where it is set up, assisting the teachers to a more efficient conduct of their programs.
4. To carry on teacher-training functions for instructors in service.
5. To prepare instructional material that will be of aid to teachers and local supervisors of vocational education.
6. To assist local communities in locating suitably qualified instructors for vocational programs.
7. To determine the amount of reimbursement from federal and state funds due the local communities.
8. To inspect the operation of local programs to see that all detailed requirements are being observed.[15]

The Purpose of the Study

For some time there has been an apparent need for a survey or a series of studies on the state supervision of industrial-arts education. As early as 1926 a study by Smith showed that city directors and supervisors were heartily in favor of having separate "State Supervisors for the Manual Arts."[16] The recent "Regents' Inquiry into the Character and Cost of Public Education in the State of New York" revealed the need for more supervision in that state even though it happens to be one of the few states that have separate supervisors for this field. In one of their reports, by Norton, the following statement is made: "Generally speaking, the industrial-arts teachers both in the urban and rural districts are without sufficient state and local supervision. Since the primary interest of the vocational and extension division is in the problems of vocational education, insufficient attention has been given to industrial-arts education, and there is danger that it may become the neglected child of the division."[17] Fales, in one of the few articles to be found on state supervision, says, "A state supervisor of industrial arts is needed in every state where industrial arts is taught, if it is to develop in a sound and economic manner."[18]

These few citations exemplify that school people have been and are thinking seriously about the problems and processes of state supervision and the educational relationships that exist between the state and local communities. These reasons, plus the fact that no similar study had previously been attempted, prompted the writer to undertake this survey. The purposes of the study here being partially reported were listed as follows:

1. To set forth certain basic policies upon which a successful program for the state supervision of industrial arts may be planned.
2. To develop and evaluate, insofar as is possible within its scope, the procedures necessary for the successful administration of such a program.
3. To discover, upon the establishment of these procedures, the extent to which the various state supervisors who visit industrial-arts teachers use them.
4. To discover the extent to which teachers of industrial arts about the country have noted the carrying out of these procedures by the state supervisors who have visited them.
5. In terms of the findings of this study, to indicate wherein fruitful changes and further investigation may be attempted, to the end that the state supervision of industrial arts may become more effective and efficient.
6. To survey the preparation of present state supervisors who visit industrial-arts teachers.
7. To establish qualifications for such office or official.
8. To present the opinions on state supervision of state supervisors, teachers, and general educators throughout the country.

The Plan of the Study

Space does not permit a discussion of the foundational writings which preceded the development of the techniques used in making the survey. Suffice it to say that all of the pertinent literature related directly or indirectly to state supervision was carefully reviewed. A preliminary questionnaire was addressed to the chief state school officer in each of the 48 states for the dual purpose of receiving their ideas on the broad principles of state supervision and also the names of the individuals responsible for the supervision of industrial-arts teachers in the respective states. Usable replies were received from 45 such officials.

As a result of this preliminary questionnaire survey and canvass of writings in the field, it was possible to formulate a preparatory set of basic policies which it seemed should underlie any effective and efficient program of state supervision for industrial-arts education. This

[14] John Dale Russell and Associates, *Vocational Education*, p. 70. Prepared for the Advisory Committee on Education, Staff Study Number 8 (Washington: Government Printing Office), 1938.

[15] *Ibid.*, p. 72.

[16] Homer J. Smith, "The Administration and Supervis'on of Vocational Education in Cities, with Particular Reference to Industrial Education," p. 173. Unpublished Doctor's Thesis, University of Minnesota, June, 1926.

[17] Thomas L. Norton, *Education for Work*, pp. 126–7 (New York: McGraw-Hill Company, Inc.), 1939.

[18] Roy G. Fales, "State Supervision of Industrial Arts," *Education*, CX (May, 1940), 579–586.

preliminary set of policies was revised in accordance with the opinions of numerous cooperators. The resulting, defined policies comprise the combined judgments of authorities in both general and industrial education. The following formulations are offered as fundamental to competent programs of state supervision for industrial-arts education:

Leadership. — A quality of true leadership rather than one of authoritative domination should characterize the state supervision of industrial-arts education.

Policy Forming. — The state supervisor should formulate, or assist in formulating, broad intelligently planned policies for the efficient and effective functioning of industrial-arts education in his state.

Improvement of Instruction. — The state supervisor should be primarily concerned with the improvement of instruction and of teacher-pupil relationships in the field of industrial-arts education.

Research. — The state supervisor should have the ability to, and the duty of initiating, planning and conducting local and state-wide researches in the field of industrial-arts education.

Service. — The state supervisor should provide various services — personal, professional, or general in nature — making possible more effective and efficient teaching of industrial arts in his state.

Promotional. — The state supervisor should purposefully and intelligently promote the cause of industrial-arts education within his state.

Using these basic policies as a guide, a detailed check list of 154 items was developed. This check list (shown later) was used in three distinct ways and for as many purposes:

1. It was sent to a number of selected educators throughout the nation. These experts acted as a jury and evaluated, in terms of desirability, the various procedures listed. They checked each item in terms of a five-point scale ranging from *very undesirable* to *very desirable*. It was possible from the combined reactions, arbitrarily to differentiate procedures under a threefold classification — those on which there was *close agreement*, those on which there was *some disagreement*, and those on which there was *considerable disagreement*.

2. The check list, with different response columns, was also sent to state supervisors in each of the 48 states. Replies were received from 42 supervisors in 36 states. The forms sent them were of such nature that they could check whether or not each listed procedure was carried out by them.

3. The check list was also sent to 605 industrial-arts teachers throughout the country, usable replies being received from 312 teachers. The forms sent to the teachers were so constructed that each teacher might indicate whether his state supervisor carries out each of the procedures listed. An additional column was included in this form so that the teacher might indicate, if necessary, that he did not know whether a given procedure was carried out in his state.

The check-list replies from the three groups constituted a basis upon which a detailed comparison could be made between what should be done in state supervision and what actually is being done.

Table I summarizes by means of percentages the returns of each group. Space does not permit inclusion of the several tables preceding the summary table, nor is it possible to describe fully the statistical procedures used in evaluating the opinions of the jury of experts as to the desirability of each item. Persons interested in such detail are invited to review the dissertation in its entirety. One statement concerning reliability will suffice for general readers.

Four months after their original responses, 11 members of the jury again filled out identical check lists. In terms of the arithmetic mean, 80.2 per cent of the items were checked in exactly the same manner as they had been previously. This showed that the opinions of these jury members tended to be stable, for they answered 123 of the items in exactly the same manner on both occasions.

The reader is cautioned against interpreting the figures found in the table with any degree of finality. He must remember the many variables inherent in a study of this kind and must make his deductions in terms of broad, general statements. An explanation of the first item will illustrate this approach and will aid in an understanding of the table.

The first statement says that "As a part of his general practices, the state supervisor visits each industrial-arts department in the state at least once each year." The letter *B* preceding the item means that there was some disagreement among the jury of experts concerning this procedure. Crossing to the columnar tabulations and under *Jury of Experts* it will be noted that 80 per cent of the jury considered this practice to be desirable, 15 per cent thought it of doubtful desirability, and 5 per cent checked it as being undesirable. Proceeding to the right, 20 per cent of the state supervisors reported that they do visit each department at least once each year, while 80 per cent said that they do not. As to the teachers' replies, 22 per cent stated that their supervisors visit them at least once each year; 33 per cent said that such is not the case, and 45 per cent were not informed sufficiently to answer the item.

The interpretation accorded these figures would be about as follows: *In terms of the findings of this study* it is desirable for state supervisors to visit industrial-arts teachers at least once each year, but a majority of them are unable to do this. It must be remembered that the supervisors might have very justifiable reasons for not following this procedure, although it was not within the confines of this study to ascertain these facts. Similar interpretations should be placed on the figures following the other items in the table.

Overview of the Findings

Space does not permit a detailed comparison of all the returns of the three groups; however, a general statement is possible. On the basis of one grouping, 49 procedures which the jury closely agreed were desirable are carried out by the majority of state supervisors. Conversely, 36 such practices considered highly desirable by the jury are not carried out by the majority of state supervisors. These 36 omitted procedures, because they are desirable, are highly significant, and indicate ways in which state supervisors may vary and improve their future activities. Twenty-six additional procedures not carried out by supervisors are considered to be desirable by the jury, but with some disagreement among jury members noticeable. Thirty-one procedures of considerable jury disagreement as to the desirability were identified. The majority of state supervisors carry out two of these, but do not carry out the other 29. Selected for lengthier discussion are those 36 desirable procedures which are not carried out by a majority of the state supervisors.

While the jury of experts considered it highly desirable for state supervisors to conduct state-wide surveys to determine the kinds and types of industrial-arts activities needed, only 29 per cent of the supervisors carry out this practice. The majority (56 per cent) do not make a practice of promoting the formation of clubs of industrial-arts teachers about the state and a slightly larger number (60 per cent) do not visit such clubs. This appears significant, as certain of the teachers commented specifically about the presence or absence of their supervisors at their club meetings.

Approximately one third (32 per cent) of the supervisors hold regular sectional meetings of industrial-arts teachers in their states. Only 32 per cent make yearly reports to the chief-state school officer or state board of education on the status of industrial arts. This is also significant, when we realize that the jury agreed almost unanimously that such a procedure should be carried out.

It is noticeable that most of the state supervisors cooperating in this study (83 per cent) do not use standard check sheets to aid them in observing departments and the work of teachers. This makes understandable the facts that very few of these sheets are placed on file in the supervisor's office and that only about one third of the supervisors use such sheets in their personal conferences. Both of these procedures were considered desirable by the jury. The jury likewise thought it a desirable practice for the supervisors to discuss and promote the *home-workshop* idea with the teachers, but only about one fourth of the supervisors reported such a practice.

It is interesting to note that only one third of the supervisors were able to render worthwhile assistance to new, beginning teachers or to others in new positions. Sixty-six per cent stated that they were unable to spend the fall months in visiting those who were experiencing their first teaching. A larger number (79 per cent) reported that they do not meet with groups of new teachers in the fall, and a still larger group (84 per cent) that they do not send out lists of helpful suggestions to beginning industrial-arts teachers.

The jury of experts was in close agreement that it would be desirable for the state supervisors to provide certain services to industrial-arts teachers. In most cases, the percentage of supervisors offering such service is very small. Stated negatively, more than two thirds of the supervisors *do not* perform any of the services mentioned in the following list. They *do not* prepare and send to teachers:

1. Notices of professional industrial-arts books
2. Notices of new shop books
3. References on related informational material

4. Occupational reading lists
5. Descriptions and illustrations of new and interesting projects seen about the state
6. Descriptions of instructional aids used in the state
7. Manipulative tips picked up on visits
8. Information received at conferences and conventions
9. Reports on significant research projects in industrial arts
10. Information about new industrial products appearing on the market

It must be remembered that the jury of experts closely agreed that such services would be desirable.

About one fourth of the state supervisors reported the sending out of safety instructions. A like number said they make a regular practice of speaking before industrial-arts seniors in teacher-training institutions to assist in their orientation and guidance. Less than one half (47 per cent) make a regular practice of collecting drawings or pictures of local industrial-arts shops for use in their work.

The following positive statements characterize less than one half of the supervisors. As regards publicity and promotional work, 28 per cent of the supervisors carry on definite publicity campaigns in promoting industrial arts in their states. A similar number (22 per cent) organize or assist in state-wide industrial-arts radio broadcasts. A larger group (41 per cent) appear before service clubs and talk on industrial arts in the state, while only 3 per cent prepare regular industrial-arts news items and send them to local papers throughout the state. Approximately one fourth (28 per cent) of the supervisors do write articles for their state education journals. As far as state-wide programs are concerned, 44 per cent call together outstanding industrial-arts teachers to work on state-wide publications; 28 per cent are members of the state curriculum committee; 46 per cent are on the executive boards of the industrial-arts section of the state education associations; and 39 per cent cooperate in promoting and establishing state-wide industrial-arts planning committees.

The Supervisor and Working Conditions

In surveying the general conditions under which the state supervisors work, a wide diversity of practice is noted. As many as 1500 schools were found to be under the supervision of one man, while the median number of schools per supervisor is 210. Only two states (New York and New Jersey) have supervisors whose duties are solely in the field of industrial arts. Connecticut has delegated such responsibilities to a teachers' college man. Several other states are considering the appointment of such an official, but to date have not done so. The remainder of those responsible for such supervision divide their time and effort between general school supervision or the oversight of trade and industrial education, with the latter group predominating.

(To be continued)

Analysis of the Duties of a Director of Vocational Education

LESTER L. FEHR*

The director of vocational education has many duties which may be clarified by a careful listing. This the author has tried to do in the analysis presented herewith.

A director of vocational education is a person in a school system who is responsible to the executive officers of the system for the organization and conduct of vocational and prevocational education presented in the day school, the evening school, or in both.

Most directors do and must perform some duties and assume some responsibilities that are directly executive and managerial. Included are activities clearly pointed toward improving the classroom instruction, and toward increasing professional growth and better morale in the teaching staff.

During the performance of any single activity, there is probably no urgent necessity for consciousness on the part of an official of how the activities should be classified, but recognizing unavoidable mixture and overlapping, the duties are classified as either administrative or supervisory.

The administrative duties are concerned with providing, and the supervisory duties are concerned with the operation of the program. Since, in some states, this double group of duties is usually performed by one person, called the director of vocational education, the following classification is made so as to include the administrative and supervisory duties of the position.

Administrative Duties

I. Survey local conditions
II. Selecting teachers
III. Determine the content of the vocational program
IV. Provide space and equipment
V. Purchase supplies
VI. Make up budget
VII. Departmental promotions
VIII. Publicity
IX. Co-ordination between school and employer
X. Co-ordination between school and local professional groups
XI. Records
XII. Research and experiment
XIII. Setting up class schedules
XIV. Arrange for teacher visitation
XV. Expansion of the program
XVI. Conduct teachers' meetings
XVII. Observation and inspection
XVIII. Planning and upgrading the staff
XIX. Placement and follow-up
XX. Legal requirements
XXI. Set up adult-training programs

I. *Survey local conditions:* A survey of industry, school, and community to determine the needs of the community.

A. Make a survey of industries.
1. Types of industries
2. Number of workers employed
3. Methods of training
4. Demand for workers
a) Skilled
b) Semiskilled
c) Unskilled
5. Occupational requirements
6. Attitude of industry

B. Make a survey of the school system
1. Type of system
2. Size of system
3. Attitude of school administration
4. Facilities available
5. Future expansion of the program
6. Type of employment secured by graduates

C. Make a survey of the community
1. Size of the community
2. Type of community
3. Type of citizen
4. Attitude toward schools
5. Employment opportunities

II. *Selecting teachers:* Selecting the teacher for the job so as to conform to the requirements of the job.

A. Have thorough knowledge of certification requirements
B. Interview applicants
C. Make recommendations
D. Keep on file list of possible available teachers

III. *Determining content of vocational program:* Analyze the survey report to meet local needs.

A. Study survey reports
B. Study available facilities
C. Set up tentative program based on community needs
D. Secure approval

IV. *Provide space and equipment:* To carry on a program of vocational education as determined by the content of the program.

A. Arrange for alterations where necessary
B. Determine additional facilities needed
C. Arrange for moving and setting up present equipment
D. Determine new equipment needed
E. Advertise for bids
F. Tabulate bids
G. Make recommendations for purchasing new equipment
H. Make floor plans for installation of new equipment

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V. *Purchase supplies:* Supplies necessary to carry on the program must be purchased according to law.

A. Make up annual requisition form
B. Secure from each teacher a requisition form filled out
C. Tabulate lists and make master copies
D. Advertise for bids
E. Tabulate bids and make up purchase lists
F. Present purchase lists to proper officer

VI. *Make up budget:* Efficiency demands operation on a budget, made in advance, comprehensive enough to cover all phases of the program.

A. Make up estimate based on previous costs
B. Determine amount of money available
C. Determine costs of new equipment and supplies
D. Balance budget
E. Submit to proper officers

VII. *Departmental promotions:* A program of teacher participation in the development of the program.

A. Prepare data on each shop and instructor
B. Consult teachers on departmental activities
C. Enlist cooperation of all interested persons

VIII. *Publicity:* A program of advertising the department and its functions.

A. Organize news-gathering agency
B. Prepare newspaper articles
C. Speak before public groups
D. Prepare news bulletins
E. Organize a community project

IX. *Co-ordination between school and employer:* Since the success of the department depends on the usability of its product, it can be best attained by co-ordination between the users and the suppliers.

A. Organize advisory committee of industrial leaders
B. Consult committee on program of training
C. Visit industry frequently for advice
D. Maintain a professional but not dictatorial attitude

X. *Co-ordination between school and local professional groups:* To maintain a professional standing, it is necessary to participate in functions of local interest.

A. Arrange for talks by shop teachers at general meetings
B. Encourage membership in professional groups
C. Provide the latest educational magazines
D. Seek the advice of members of professional groups

XI. *Records:* An adequate system of records means efficiency, and the importance of having an adequate system of records must not be overdone or minimized.

A. Continuous inventory of equipment
   1. Design adequate form
   2. Prepare instructions for taking inventory
   3. Have central place in each department for inventory
B. Continuous inventory of supplies
   1. Design adequate form
   2. Prepare instructions for keeping inventory up to date
   3. Have central place in each department for inventory
C. Teacher's schedules
   1. Make teacher assignments by class and period
   2. Make schedule according to period
   3. Make master schedule
D. Attendance records
   1. Make up class rolls
   2. Organize system of checking attendance
   3. Have weekly reports made
   4. Encourage regular attendance
E. Production records
   1. Devise adequate form
   2. Receive monthly reports
   3. Tabulate and check monthly reports
   4. Make up form for reporting production work to superintendent
F. Requisition records
   1. Devise adequate form
   2. Receive at stated time
   3. See that requisitions are filled at stated time
   4. Keep record of requisitions
G. Safety records
   1. Devise adequate form
   2. Receive reports regularly
   3. Give publicity to accident prevention
H. Maintenance of cost accounting system
   1. Devise form
   2. Provide teachers with cost lists
   3. Establish project prices
   4. Establish system of collection
   5. Make annual or semiannual report
I. Set up standards of admission and promotion
   1. Set age limit according to law
   2. Set up flexible plan
   3. Determine achievement standards for grades
   4. Determine requirements of trade
   5. Completion carries high school diploma
   6. Post requirements
   7. Inform frequently both students and teachers

XII. *Research and experiment:* New methods must be tried and new content evaluated in the light of improving the existing program.

A. Statement of the problem
B. Give reasons for selection
C. Determine technique to be followed
D. Summarize results
E. Draw conclusions
F. Apply conclusions
G. Evaluate results

XIII. *Setting up class schedules:* The proper distribution of teachers' and pupils' time makes for better administration.

A. Make list of sections and periods
B. Make section distribution schedule
C. Check on master schedule
D. Make duplicate copies

XIV. *Arrange for teacher visitation:* Just as travel is broadening, so are these visits; to see how others do, important in the development of the teacher.

XV. *Expansion of the program:* Keeping awake to new developments and community needs permits expansion of the program.

A. Confer with industry as to their needs
B. Keep industrial advisory committee informed of new development
C. Determine activities for which training can and should be offered

XVI. *Conduct teachers' meetings:* Vitalize teachers' meetings so as to make for a spirit of cooperation and good will.

A. Start meeting at appointed time
B. Plan details thoroughly
C. Have good reason for meeting
D. Choose convenient time and place
E. Provide for teacher participation

XVII. *Observation and inspection:* To observe the work of individual teachers and inspect equipment for greater efficiency of the program.

A. Observe teaching
B. Observe pupil reaction
C. Suggest methods of presentation
D. Suggest methods of organization
E. Criticize constructively
F. Commend good work

XVIII. *Planning and upgrading of staff:* Arrange for and carry on programs designed to improve the professional rating of the staff.

A. Suggest extension classes
B. Organize extension classes
C. Set the pace
D. Encourage attendance at educational meetings

XIX. *Placement and follow-up:* The success of the program depends on the salability of the product.

A. Recommend pupils for positions
B. Maintain employment file
C. Accompany boy to industry
D. Recommend on merit only
E. Maintain friendly relations with the boy
F. Contact him frequently after entering employment
G. Keep a record of these visits
H. Stimulate him by asking his help in determining the policies of the department of which he is a graduate

XX. *Legal requirements:* To conduct the program so as to meet all requirements of the safety code and the state program code.

A. Study school code as it effects vocational education
B. Purchase supplies and equipment according to law
C. Be familiar with teacher certification requirements
D. Be familiar with accident procedure
E. Study safety requirements of the Department of Labor and Industry

XXI. *Set up adult-training program:* To meet the needs of the adults in the community, is a basic requirement of a functioning system of local public education.

A. Determine need
B. Set up curriculums
C. Secure teachers
D. Arrange schedule
E. Secure rooms (suitable)
F. Administer the program

Supervisional Duties

I. Maintenance of buildings and equipment
II. Conference with teachers
III. Classroom visitations
IV. Illustrative teaching
V. Guidance and counseling
VI. Rating teachers
VII. Reports and records
VIII. Develop and improve material of instruction
IX. Provide opportunity of visitation
X. Supervision of production work
XI. Supervision of exhibits
XII. Selection of text and reference material
XIII. Handling of numerous cash accounts
XIV. Cooperation between departments
XV. Make bibliography of reference material
XVI. Grading standards
XVII. Special classes

I. *Maintenance of buildings and equipment:* The building and equipment of a school are beyond the control of a director as to quality and quantity, but the quality may be preserved through care and proper use.

A. Buildings
   1. Receive requisition for repairs
   2. Receive requisition for alterations
   3. Assign repair to departments
   4. Check upon completion
B. Equipment
   1. Repair
   2. Replacement
   3. Rearrangement
   4. Transfer
   5. Regulation for use
   6. Safeguards

II. *Conference with teachers:* The welfare of the school demands periodical conferences and such are recognized as an essential element in preserving the unity of the system. These conferences are needed for considering the Educational Policy of the school.

A. Convenient time and place
B. Courteous reception
C. Nature of meeting
   1. Demonstration lesson
   2. Accident and fire prevention
   3. Budget
   4. New school laws
   5. Home, school, and factory visitation
   6. Court cases
D. Plan conference details
E. Encourage teachers' participation
F. Check results of teachers' reaction

III. *Classroom visitation:* Should be made periodically, to observe each teacher's work and some type of standard form should be used to aid director in making final rating of teacher's efficiency. Moreover, teachers should know when the director is to make his visit. The director should ask and be asked to visit at a certain time to observe certain types of presentations, drills, and tests.

A. Observation of the lesson
   1. Teacher's aim
   2. Pupil's problem
   3. Order of teaching
      a) Preparation
      b) Presentation
      c) Application
      d) Testing
      e) Generalization
   4. Type of lesson
   5. Questions
      a) Method
      b) Kind
   6. Illustrations
   7. Correlation
   8. Assignment of new lesson
B. Observation of the pupils
   1. Attitude toward teacher and fellow members
   2. Preparation for lesson
   3. Contribution to lesson
   4. Interest
   5. Mastery of lesson
C. Observation of teacher
   1. Appearance
      a) Dress
      b) Manner
      c) Poise
      d) Tact
   2. Voice
      a) Speech
      b) Command of expression
   3. Professional and ethical attitude
   4. Imagination
   5. Sense of humor
   6. Special preparation for lesson
   7. Attitude toward pupil
   8. Discipline
   9. Ability to adjust lesson to unanticipated conditions
D. Observation of general conditions
   1. Physical
      a) Light, temperature, and ventilation
      b) Materials, drawings, tools, and equipment
   2. Human atmosphere
      a) The pupil — eagerness, fairness, courtesy, and happiness
      b) The teacher — friendliness, interest, and patience

IV. *Illustrative teaching:* The director is responsible for the efficiency of the program, and the success of this program is largely dependent upon the quality of the teacher. It is the director's duty to illustrate new method teaching skill and technique.

A. Sample teaching
B. Demonstration of new methods
C. Demonstration of new skills
D. Demonstration of new technique
E. Use of new instruction material
F. Use of new tests and measurements
G. Use of new visual aids

V. *Guidance and counseling:* Practically everyone is or will be engaged in activities by which he earns a living; he must make definite choice of an occupation, and he must prepare for it. Even after he gets a job, there are numerous adjustments that must be made. To make these choices wisely, he needs facts and experience, he neeeds assistance to a greater or lesser degree.

A. Test for abilities
B. Interests and hobbies
C. Choice of occupation
D. Prepare for vocation
E. Securing work and placement
F. Readjustment
G. Promotion
H. Personal relation to occupational life
I. Use of leisure time

VI. *Rating teachers:* Every director in rating of teachers should remember that this is a very important duty, and one that will be for the good of the system as well as for the sake of justice to the teachers. He should be responsible for comparing his teachers as to general competence and as to efficiency in the special type of work to which they have been assigned.

A. Delevop rating scale
   1. Scholarship
   2. Character
   3. Personality
   4. Knowledge of subject matter
   5. Classroom management
   6. Ability to teach
   7. Adaptability, loyalty, cooperation, and tact
   8. Appearance and health
B. Recommendation for
   1. Promotion
   2. Demotion
   3. Dismissal
   4. Transfer
   5. Reassignment
   6. Appointment
C. Schedule for visitations
D. Previous experience
E. Professional advancement
F. Extracurricular activities

VII. *Reports and records:* These are presumably written for the purpose of conveying specific information with regard to a specific situation on a specific job. It is valuable in proportion as it gives all necessary information and comment for present or future reference.

A. Reports
   1. Monthly and term reports
   2. Accident reports
   3. Emergency reports
      a) Breakdown of equipment
      b) Building repairs, etc.
   4. Textbook inventory
   5. Teachers' handbook inventory
   6. Teachers' reference material inventory
   7. Project reports
B. Records
   1. Trade analysis
   2. Job analysis
   3. Survey and research
   4. Lesson plans
   5. Tests
   6. Questionnaires
   7. Personal charts
   8. Grade cards
   9. Class schedules
   10. Class enrollments
   11. Distribution of grades
   12. Repair costs

VIII. *Develop and improve materials of instruction:* Requires survey of local industries to find the needs and interests of the local community. After the formulation of curriculum, improvement and revisions are necessary to keep instruction up to date with changing industrial processes and materials.

A. Analysis of courses
B. Formulation of curriculum
   1. Objectives
   2. Course of study
   3. Short unit courses
   4. Special classes
C. Revision or modifications
D. Standardize tests
E. Evaluate results
F. Suggest new methods
G. Check new points
H. Organization of material
I. Filing methods
J. Reorganization of courses

IX. *Provide opportunity for teachers' visitation:* Opportunity for teachers to visit other schools and industrial plants. These are for the purpose of obtaining advice, help, and receiving expert advice on a given topic.

A. Number required
B. Suggest visit for
   1. Advice
   2. Help
   3. See expert at work
C. Set suitable date
D. Arrange for substitute
E. Report on visit

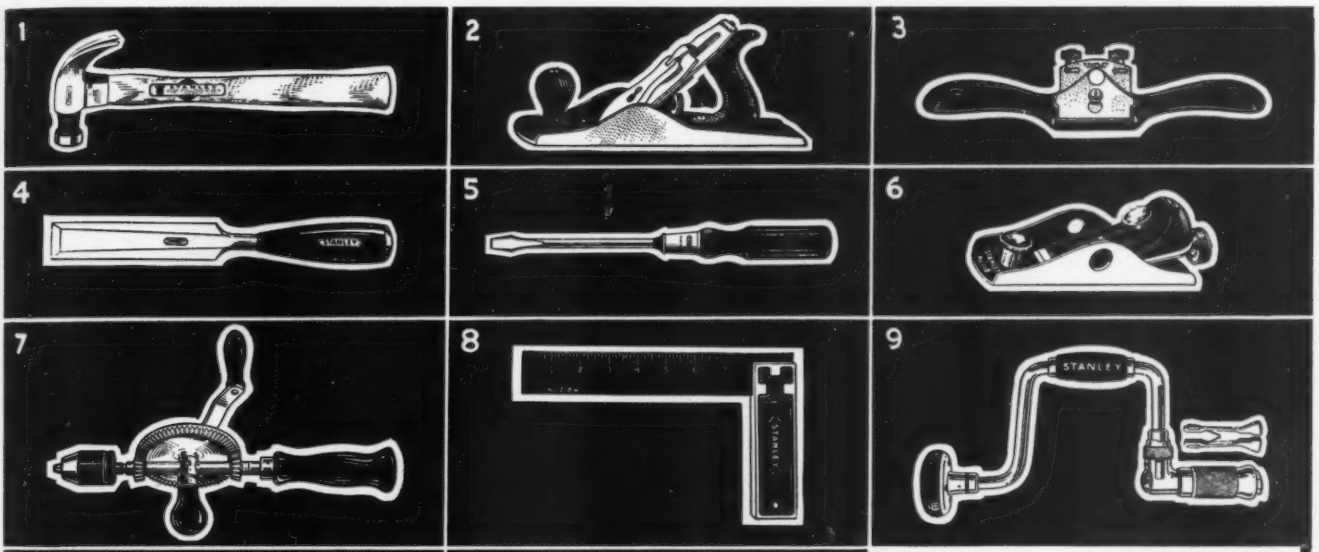
X. *Supervision of production work:* This work must be supervised, or a school shop soon becomes a jobbing shop or repair shop and interferes with class instruction. Production work should be done only when it has instructional value and fits into the course of study.

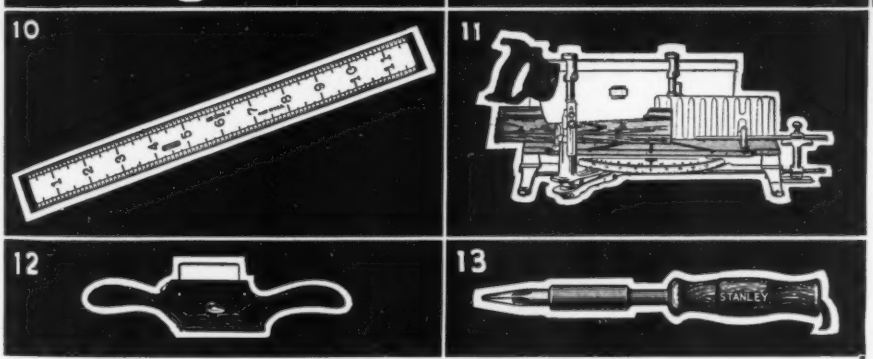
A. Approve production work
B. Job order
C. Check material on hand
D. Check jigs, fixtures — special tools
E. Order material and tools if necessary
F. Follow-up
G. Inspection
H. Delivery
I. Filing of orders
J. Cost records

XI. *Supervision of exhibits:* By arranging exhibits of work of the pupil, a director can

(Continued on page 14A)

STANLEY "Boy Proof" TOOLS
FOR SCHOOL SHOPS





1 No. 52½ 10 oz. HAMMER. "Super-heat-treated" head. "Evertite" oil treated handle of selected straight grain hickory. Patented wedges. Five other sizes.

2 No. 5¼ JUNIOR JACK. Well balanced, light-weight. Ideal size for Junior High School student. 11¼" long. 1¾" cutter.

3 No. 151M SPOKE SHAVE. Malleable Iron – practically unbreakable. Cutters of finest steel correctly hardened, tempered and sharpened.

4 No. R40 "EVERLASTING" CHISEL. No lost or battered handles. Rubber composition handle, practically unbreakable, moulded about shank. Blade, shank and head one piece of finest steel. All sizes: ⅛" to 2".

5 No. 20 SCREW DRIVER. Standard blade. Blade, shank and head hot forged from one piece of steel.

6 No. 118 BLOCK PLANE. All steel. Minimum number of parts. Lowest cutting angle.

7 No. 626 HAND DRILL. New chuck with hair-pin type springs. Heavy crank, solid wheel, several other important features: ⅜" chuck capacity. Hand drill No. 617 has ¼" chuck capacity.

8 No. 12 TRY SQUARE. Graduated in eighths of inches. Japanned finish handles. Blades have gun black finish and white figures.

9 No. 919 BIT BRACE. Self centering chuck, all parts locked in place. Bronze bushed ball bearing head. Made with 8, 10, 12 and 14 inch sweep.

10 No. 34½V BOXWOOD RULE. Improved vertical figures – easy to read in any position. One side graduated in eighths of inches – other side in sixteenths. Brass tips protect ends.

11 No. 2246 MITRE BOX. Simplified design. Swivel and uprights one piece of malleable iron. Malleable iron saw guides with roller bearings.

12 No. 80M SCRAPER. Practically unbreakable. Body and handles one piece of malleable iron.

13 No. 340 STANLEY ELECTRIC SOLDERING IRON, 95 Watts. Quick Heating – even temperature. Replaceable tips. Instant adjustment of handle for length. Hermetically sealed unit. Long life and dependability. Seven other sizes – wound for standard voltages.

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Anvil Tools, Tongs, Hammers, etc.

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TRADE STANLEY MARK

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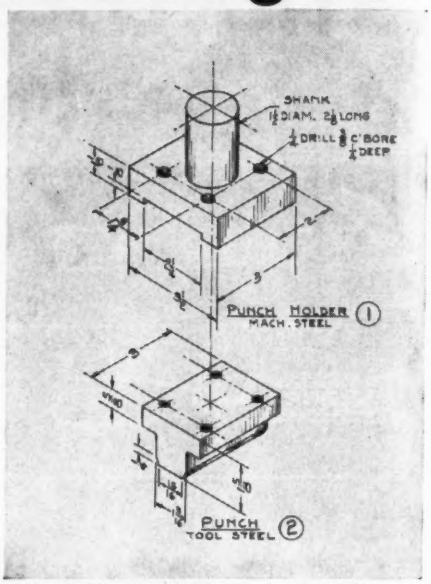
Project for Young American Designers

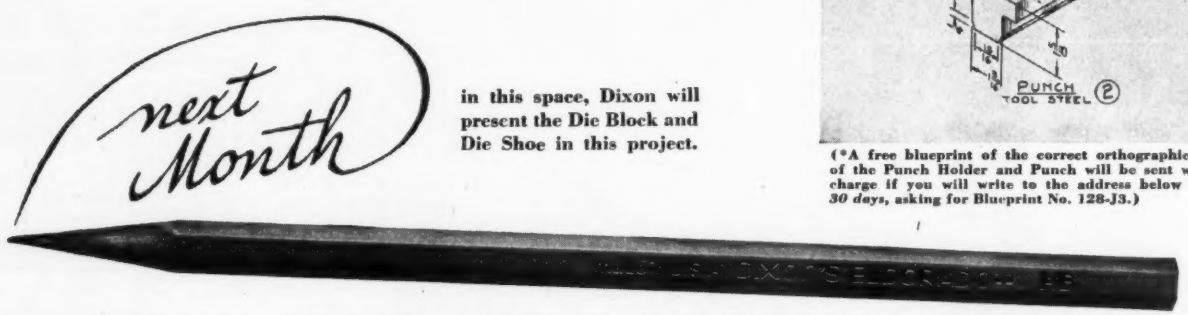
No. 1

Three drawings constitute "A Simple Punch and Die Project." The first of the series appears here. Two others will follow in succeeding issues of this magazine. The project should prove interesting and instructive to your students. Your students are to draw the orthographic views.*

In following the project, why not give the pupils the advantage of using *Typhonite* Eldorado Pencils? Their superior quality facilitates the work and encourages neatness and clarity—the drawing of detail in a manner to produce the clearest blueprints. It's a lesson calling for the finest of pencils!



(*A free blueprint of the correct orthographic views of the Punch Holder and Punch will be sent without charge if you will write to the address below *within 30 days*, asking for Blueprint No. 128-J3.)



SCHOOL BUREAU, JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.

(Continued from page 140)

create news. Not only will it reach those who attend the exhibit, but the local press will often carry descriptive accounts to a much wider field.

A. Arrangement for exhibits
B. Type of work to be exhibited
C. Arrangement of exhibit
D. Arrangement of transportation (to and from)
E. Arrangement for safeguard
F. Arrangement of pictures of exhibit
G. Advertising for exhibit
H. Public reaction

XII. *Selection of text and reference material:* There is no means that equal a good textbook for logical organization of instructional material. Textbook and reference material possess many valuable pedagogical devices which should be utilized by the teacher and the student such as illustrative material, pictures, diagrams, outlines, tables, etc.

A. Objective of course
B. Contents of course
C. Survey field for text material
D. Survey industry for reference material
E. State department for bulletins
F. Federal department for bulletins
G. Index of texts and reference materials

XIII. *Handling of numerous cash accounts:* In vocational shop, numerous cash accounts are handled. These should be handled and records kept accurately with the least amount of time, and should be kept separate from other accounts.

A. Cash from project
B. Cash from broken and lost tools
C. Profit from sale of tools
D. Petty Cash
E. Records of accounts

XIV. *Cooperation between departments:* Is generally recognized in the business world as one of the most important efficiency factors in reducing production costs and time. This statement will apply equally well in the case of vocational education.

A. Difficulties in internal cooperation
B. Secure internal cooperation
C. Maintaining internal cooperation
D. Rewards of internal cooperation
E. Efficiency values of cooperation

XV. *Make bibliography of reference material:* This should be on a standard form (see library card catalog, *Readers Guide*, etc.). It is important to record complete information for each reference, such as article, author, publisher, edition, date, and the like.

A. Survey
   1. Check library catalog indexes
   2. Manufacturing publications and charts
   3. Publishers' announcements of new books
   4. Check present text used
   5. Federal bulletins
   6. State bulletins
B. List all desired material
C. Print sheets or card
D. Methods for additions
E. Filing system

XVI. *Grading standards:* Grading of work is a distinct factor in efficient teaching. Evaluating work to some grading standard can be used not only for final records, but can and should be used as a distinct teaching device.

A. Uniform standard
   1. Quality of work
   2. Quantity of work
   3. Effect
   4. Knowledge acquired
   5. Attitude
   6. Attendance
B. Evaluating standard
C. Economy of teachers' time
D. Frequent grading
E. Access to grades
F. Make grade permanent
G. Grade card (students)
H. Permanent grade card (for file)

XVII. *Special classes:* Is the outgrowth of the fact that pupils leave our regular school for various reasons. They realize in later years that special training is required, and they seek same in special classes.

A. Special classes
   1. Cooperative classes
   2. Part-time classes
   3. Foremanship classes
   4. Conference leader classes
   5. Trade — extension classes
   6. Short unit courses
   7. Service occupation classes
   8. Distributive occupation class
   9. CCC
   10. NYA
   11. Rehabilitation

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Wright, J. C., and Allen, C. R., *Administration of Vocational Education* (New York: Wiley, 1926).

——— *Supervision of Vocational Education* (New York: Wiley, 1926).

Payne, A. F., *Administration of Vocational Education* (New York: McGraw-Hill Book Co., 1924).

(Continued on page 22A)

YOU THINK IT UP—

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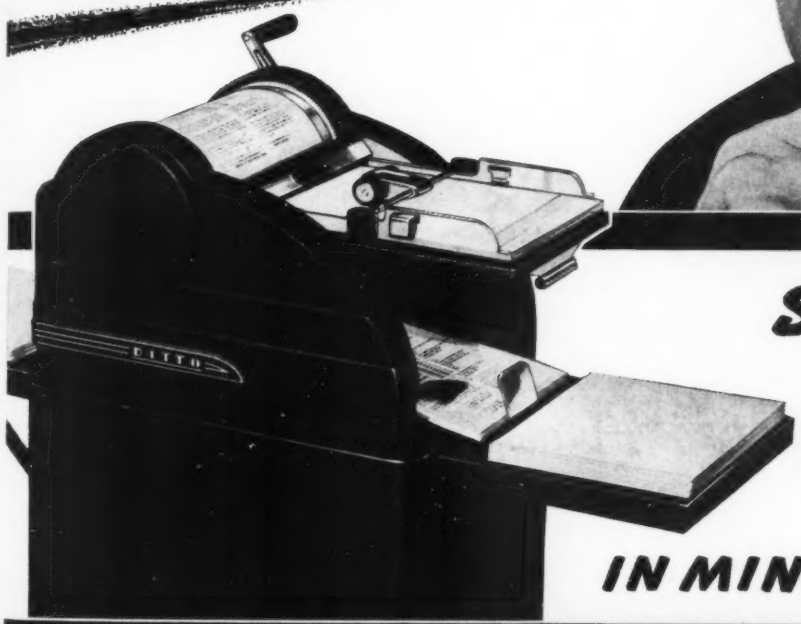

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Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

BLACKBOARD — permanent or portable
BOOKCASE
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.
CHAIRS — teacher's and tablet arm
CORE OVEN — for patternmaking class
DESK — teacher's, with drawer compartments
FURNACE — for melting soft metals (for patternmaking class)
GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat
GLUE WARMER OR COOKER — 1- to 5-gal. capacity
GRINDER
- *a*) Automatic knife, direct-motor-type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbetting. Safety-cylinder type, equipped with safety guard
- *b*) 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbetting. Jointer to be equipped with safety guard

LATHES
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible
SANDER
- *a*) Belt, direct motor drive
- *b*) Disk, motor or belt driven
- *c*) Oscillating spindle, motor driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical spindle and disk sander

SAWS
- *a*) Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct motor or belt driven
- *f*) Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g*) Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 to 16 in., motor driven
- *j*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cutoff gauges

SHAPER
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw
VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.
WOOD TRIMMERS — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

AWLS — brad, assorted sizes
BEVELS
- *a*) Protractor
- *b*) Sliding T, 8 in.

BITS
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅞ in. to 1½ in.
- *g*) Expansive, ⅞ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

BLOWTORCH
BROOMS
BRUSHES
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round
CAN OPENER
CARVING TOOLS
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

CHISELS
- *a*) Cold, machinists', ⅜ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c*) Socket firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d*) Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e*) Tanged firmer, bevel edge, ⅛, ¼, ½, ¾, 1, and 1¼ in.

CLAMPS
- *a*) Bar, 24, 36, 48, and 60 in.
- *b*) Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.
- *c*) Malleable-iron C, 4, 6, and 8 in.

DIVIDERS — wing, 6 in. and 10 in.
DOWEL PLATE — 6 in. long
DOWELING JIGS — with bushings
DRAWKNIVES — 7 in.
DRILL
- *a*) Automatic hand, with 8 drill points
- *b*) Chuck, 0 to ⅜ in.
- *c*) Hand, 0 to ⅜ in., for round-shank drills
- *d*) Star, for concrete, ½ in. and ¾ in.

FILES
- *a*) Auger bit, assorted, 6 in.
- *b*) Cabinet, 8 in. and 10 in.
- *c*) Card and brush
- *d*) Flat, wood, 10 in.
- *e*) Mill, bastard cut, 12 in.
- *f*) Round, bastard cut, 12 in.
- *g*) Taper, slim, 5½ in. and 7 in.

FIRST-AID CABINET AND SUPPLIES
GAUGES
- *a*) Bit, adjustable
- *b*) Jointer
- *c*) Marking, metal or hardwood
- *d*) Mortise, metal or hardwood
- *e*) Panel

GLASS CUTTER
GOUGES
- *a*) Tanged firmer, outside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
- *b*) Tanged firmer, inside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
- *c*) Spoon, ½, ¾, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.
HATCHET — bench, 4-in. cut
JARS — earthenware, 1-qt. capacity
KNIVES
- *a*) Jointer, to fit power machine
- *b*) Planer, to fit power machine
- *c*) Sloyd, 3-in. blade

LEVELS
- *a*) Wood, 24 in.
- *b*) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head
NAIL SETS — 1/16 in. and 3/32 in. points
OILERS — bench, 1/3 pt., coppered, best grade
OILSTONES
- *a*) 1 by 2 by 8 in. in iron box
- *b*) Gouge slip, medium, 4½ by 2⅛ by ⅝ by 5/16 in.
- *c*) Gouge slip, fine, 3 by 2 by ⅜ by ⅛ in.

PINCERS — 6 in. carpenters'
PINCH DOGS — ¾, 1, and 1¼ in.
PLANES
- *a*) Block, adjustable, 6 in. long, 1⅝-in. cutter
- *b*) Circular
- *c*) Combination, adjustable
- *d*) Core box
- *e*) Duplex, fillister and rabbet
- *f*) Fore, ⅛ in., 2⅜-in. cutter
- *g*) Irons, double
- *h*) Jack, 14 in., 2-in. cutter
- *j*) Jointer, 24 in.
- *k*) Round, wood, 1¾ in.
- *l*) Router
- *m*) Smooth, 9 in., 1¾ in. or 2-in. cutter

PLIERS
- *a*) Roundnose, 5 in.
- *b*) Side-cutting, 6 in.

PUTTY KNIVES
RASPS — half round, wood, 10 in.

(Continued on page 20A)

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Issued 6 Times During Each School Year

For many years, craftsmen and industrial education instructors have found the pages of this sparkling magazine, the Deltagram, a splendid source for new, different and novel projects. Each issue carries a wide range of things to be made in the shop—running from unique novelties and one-session items to more elaborate and advanced projects, each one shop-tested by a practical shop man. Special emphasis is placed on fresh, up-to-the-minute ideas. Adequate working drawings and photographs feature each page. In addition, each issue contains useful shop hints and shop kinks, particularly in connection with the most effective operation and maintenance of the newest motor-driven tools. Subscription rates only 50 cents a year.

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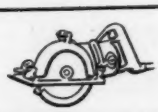

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Lighter, more powerful. A size for every drilling job in war construction and production.

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Sand, grind, file, polish on all curved or flat surfaces.

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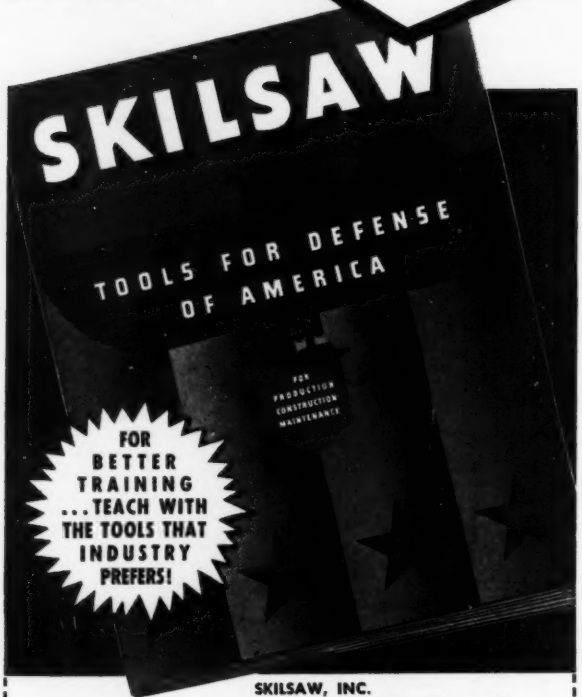
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Please send immediately the new SKILSAW Special Defense CATALOG, without charge to:

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School_____

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(Continued from page 16A)

RULES
- *a*) Board
- *b*) 1 ft. or 2 ft. graduated by 8ths and 16ths
- *c*) Shrink, ⅛ in., 3/16 in.

SAWS
- *a*) Back, 12 in., 14 point
- *b*) Band, to fit power machine
- *c*) Compass, 10 in.
- *d*) Coping, frames
- *e*) Coping, blades
- *f*) Crosscut, 9 tooth, 22 in. long
- *g*) Crosscut, circular for power machine
- *h*) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
- *j*) Hack, frames, 10 in. or adjustable
- *k*) Hack, blades, 10 in.
- *l*) Keyhole, 10 in., 10 point
- *m*) Rip, 7 point, 22 in. long
- *n*) Rip, circular for power machine
- *o*) Set, 10 points per inch and finer
- *p*) Set, 10 points per inch and coarser
- *q*) Turning frame, 14 in.
- *r*) Turning blades, 3/16 by 12 in., 10 tooth
- *s*) Miter box, 24 by 4 in. saw, 7-in. capacity at miter

SCRAPERS
- *a*) Cabinet
- *b*) Glue, triangular
- *c*) Veneer, blade, 2¾ in. long, handle 11 in. long

SCREW DRIVERS
- *a*) Cabinetmakers', 4, 6, and 8 in.
- *b*) Quick return, spiral ratchet

SHOOT BOARD — and plane

SNIPS — tinners', forged steel, 2½-in. cut

SPOKESHAVES — adjustable, raised handle, 10 in. long

SQUARES
- *a*) Combination, 12 in.
- *b*) Try-, iron handle, 8 in.
- *c*) Framing, 2 ft.

STEEL FIGURES — hand cut, ⅛ in.

TAPELINE — 50 ft., steel

TRAMMEL POINTS — adjustable metal frame, steel points

TURNING TOOLS
- *a*) Calipers, 6 in. inside and outside
- *b*) Calipers, 12 in. inside and outside
- *c*) Parting tools, ⅛ in.
- *d*) Round point, ¼ in., ½ in., ¾ in.
- *e*) Spear point, ¼ in., ½ in., ¾ in.
- *f*) Square point, ¼ in., ½ in., ¾ in.
- *g*) Turning chisels, ¼ in., ½ in., ¾ in.
- *h*) Turning gouges, ¼ in., ½ in., ¾ in.
- *j*) Turning skews, L.H., ¼ in., ½ in., ¾ in.
- *k*) Turning skews, R.H., ¼ in., ½ in.

VISE — 3-in. jaw, anvil face

WRENCHES
- *a*) Adjustable, 8, 10, and 12 in.
- *b*) Headless setscrew
- *c*) Pipe, 10 in. and 12 in.
- *d*) S type or open-end type to fit ⅛-in. to 1-in. N.C. nuts

Woodworking— Materials and Supplies

ALCOHOL

BENZINE

BRADS — ⅜ in., ½ in., and ⅝ in. No. 20; ¾ in. and ⅞ in. No. 19; 1 in. No. 18; 1¼ in. and 1½ in. No. 16; 1¾ in. No. 15; 2 in. and 2½ in. No. 14

CARBON PAPER — black

COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion

COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lampblack, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion

DECALCOMANIA TRANSFERS

DOWEL PINS AND PLATES

DOWELS: hardwood, 3-ft. lengths, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.

ENAMEL
- *a*) Selected colors
- *b*) Undercoater

FILLERS — paste: natural, golden oak, dark oak, and mahogany

FILLETS — leather, ¼ in. and ½ in.

GLUE
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports

HOOKS
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow

LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine

In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking

Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths

MOLDINGS

NAILS
- *a*) Common, 6d, 8d, and 10d
- *b*) Flathead, ½ in. No. 20, ¾ in. No. 19, 1 in. No. 18, 1¼ in. and 1½ in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

OIL
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

(Continued on page 22A)

AIR RAID 50 YEARS AGO

No. 100-24-DS Open Frame Shop Bench. 5′ long, 24″ wide, 36″ high. 2¼″ Edge Grain Maple Top.

No. 252-27-H Shop Bench with Drawer and Cupboard Unit. 6′ long, 27″ wide, 32″ high. 2¼″ Edge Grain Maple Top.

No. P-611 Drafting Table. 42″ long, 32″ wide, 38″ high. Softwood top.

Impossible, of course, but if there had been, the village blacksmith in some remote hamlet might have pounded out a warning on his anvil.

Today, Educators in small towns, as well as large metropolitan centers, are stressing different kinds of warnings. They know personnel must be trained to keep our men in the Army and Navy afield and afloat. Shipyards, ordnance plants, and materiel production centers all demand trained engineers and craftsmen. It is up to the Educators of America to make their warnings sufficiently concrete. Facilities adequate enough to provide a constant and ever increasing supply of trained men for industry must be provided.

Sheldon herewith presents a line of training accessories that have already marched to war via Army and Navy training centers, civil vocational schools and shops, industrial defense plants, and materials-testing research and control laboratories all over the land.

Write today for the Sheldon Catalog of Shop Benches and Drafting Tables.

No. 180-24-DS Open Frame Shop Bench. 8′ long, 24″ wide, 32″ high. 2¼″ Edge Grain Maple Top.

No. 700-27-A Shop Bench with Cupboard Unit. 6′ long, 27″ wide, 36″ high. 2¼″ Edge Grain Maple Top.

No. N-344 Welding Bench. 36½″ long, 36½″ wide, 33½″ high. (Fire Brick in Top not included.)

No. N-57 Electrical Bench. 8′ long, 40″ wide, 32″ high. 2¼″ Edge Grain Maple Top.

No. N-60 Sheet Metal Bench. 8′ long, 40″ wide, 32″ high. 2¼″ Edge Grain Maple Top.

E. H. SHELDON & COMPANY

MUSKEGON 723 NIMS STREET MICHIGAN

FOR EVERY SCHOOL SHOP NEED

The Hargrave line of Clamps, Chisels and Punches are INDIVIDUALLY TESTED to insure the efficient and lasting service which they will give not only to industry but in school shops as well.

Made of the finest quality materials under expert workmanship, they will give satisfaction and above all, Hargrave Clamps, Chisels and Punches are economical.

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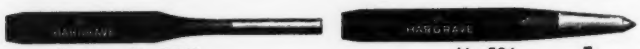

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Hargrave Chisels and Punches cut faster, last longer. Trip hammer forged, individually tested. Large selection of styles and sizes available.

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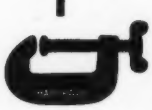
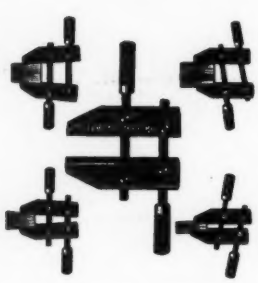


Hargrave Clamps are designed and built to give utmost satisfaction for many, many years.



All sizes and styles for every type and kind of work available.

Write for catalog illustrating the complete line and prices.

THE CINCINNATI TOOL CO.

Waverly and Main Aves.

Cincinnati, Ohio

(Continued from page 20A)

OVERLAY CARVINGS
PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply
PATTERN LETTERS
PINS — escutcheon
PUMICE STONE — No. 0
RAPPING PLATES
ROTTENSTONE
SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, ½, 1
Garnet finishing paper, 6/0, 4/0
Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order
SCREW EYES
SCREWS
a) Flathead, brass, No. 3 by ⅜ in., No. 4 by ½ in., No. 5 by ⅝ in., No. 5 by ¾ in., No. 6 by ¾ in., No. 7 by ⅞ in., No. 8 by 1 in., No. 10 by 1¼ in., No. 10 by 1½ in., No. 12 by 1¾ in., No. 12 by 1¾ in., No. 10 by 2 in.
b) Flathead, bright, No. 3 by ½ in., No. 4 by ½ in., No. 6 by ¾ in., No. 7 by 7⅞ in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1¼ in., No. 10 by 1¼ in., No. 14 by 1¼ in., No. 10 by 1½ in., No. 12 by 1½ in., No. 10 by 1¾ in., No. 12 by 1¾ in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2¼ in., No. 14 by 2¼ in., No. 14 by 2½ in.
c) Oval head, brass, No. 5 by ¾ in., No. 6 by ¾ in., No. 7 by ⅞ in., No. 8 by 1 in., and No. 10 by 1¼ in.
d) Roundhead, blued, No. 3 by ⅜ in., No. 3 by ½ in., No. 5 by ¾ in., No. 6 by ¾ in., No. 7 by ⅞ in., No. 8 by 1 in., No. 10 by 1¼ in., No. 10 by 1½ in., No. 12 by 1½ in.
e) Roundhead, brass, No. 3 by ⅜ in., No. 4 by ½ in., No. 4 by ⅝ in., No. 5 by ¾ in.
SHELLAC
a) Orange, cut 4 lb. to the gal.
b) Sticks, assorted colors
c) White, cut 4 lb. to the gal.
NOTE: Shellac should be kept in glass or earthenware containers
STAINS — oil, spirit or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut
STEEL WOOL — No. 0 and No. 2/0
TURPENTINE
TWINE
VARNISH — coach, flat, remover, spar, and rubbing
WASTE — cotton, white
WAX — bees and finishing
WHITE LEAD

Duties of the Director

(Continued from page 140)

Smith, H. J. *Industrial Education* (New York: Century Vocational Ser., Century, 1927).

Struck, F. T., *Methods and Teaching Problem in Vocational Education* (New York: Wiley, 1929).

Land, S. Louis, "Duties, Qualifications, and Responsibilities of Director of Vocational Education," *Industrial Arts Magazine*, October and December, 1925, and February, 1926.

Vocational Education Bulletin No. 1, U. S. Department of Interior, Washington, D. C.

Vocational Education Bulletin No. 15, U. S. Department of Interior, Washington, D. C.

Graphics-Arts Progress

R. RANDOLPH KARCH*

Now is the time to promote the employment of young men and women studying graphic-arts subjects. Many young men are leaving the graphic-arts industries either because they are drafted, or are entering the defense industries to make more money, or in the hope that as such they will be deferred by the selective service boards.

The graphic-arts industries are not much busier than before our active participation in helping the Allies, but they do need workers vitally. The condition will become worse, not better.

Now is the time to build upon better trade relations, and induce printers and lithographers to think of the local trade school or vocational high school when they need workers. Now is the time to build these ties, in the hope that the school will be remembered when conditions return to normal.

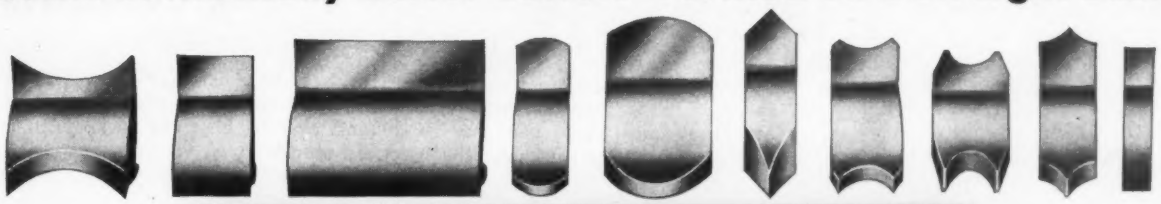
It is not meant that the schools should be stripped of students, as many schools are already feeling the pinch of small classes. It is meant that the cooperative plan be built up, to condition the thinking of local industries in regard to the worth of the school.

One graphic-arts school at the present writing has 92 co-op students out of a total enrollment of 136. This means that the school has set a new high in giving the printers what they want, and when they want it. This service will be greatly appreciated, and will carry over to the lean years which may follow with reference to employment.

(Continued on page 24A)

*Principal, Printing High School, Cincinnati, Ohio.

Some of the Many Carter Cutters—Formed on a Straight Base

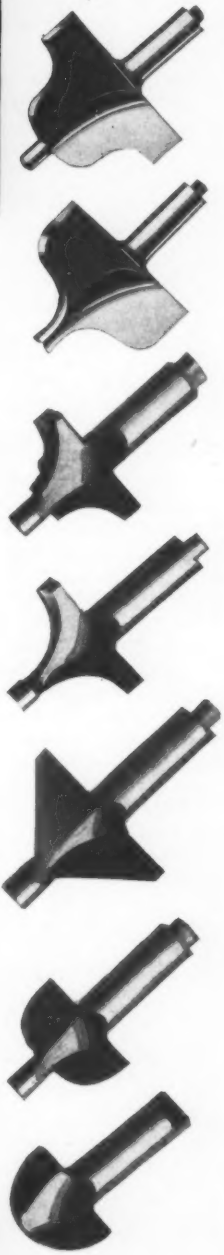


Carter Bits

500 DIFFERENT CUTS

With Only $6.00 Worth of Carter Bits and Cutters

Carter Bits



You don't need an expensive supply of Bits and Cutters to turn out work with the originality and style of expert craftsmen. Your students can cut an endless variety of new contours, patterns, and ornaments by using relatively few Carter Bits and Cutters in various combinations.

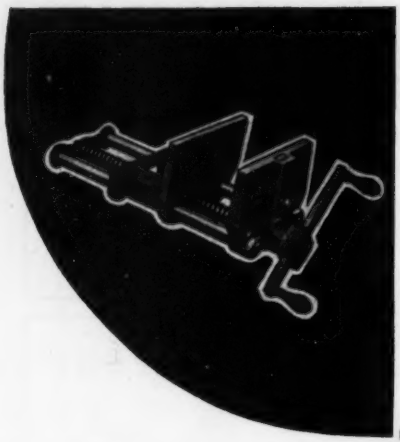
For example, 3 basic cutters will make some 500 distinctive cuts, when mounted in the Carter Tilting Spindle Shaper in different ways. At a surprisingly low cost, you can add the "something new" that will dress up any project.

Every Carter Bit and Cutter has been designed so that you can sharpen it on the flat surface without changing the contour. With their solid construction they can be run faster without vibration.

Carter offers an exceptionally wide variety of Bits and Cutters from stock . . . straight, pilot and spiral bits, and hundreds of contours in cutters. Special shapes can be made to order. Cutters tipped with Tungsten Carbide for extra long service between grinds can also be furnished.

Write for a folder describing Carter Bits and Cutters, and select the ones that will "pep up" your class work. **R. L. Carter Division,** The Stanley Works, 112 Elm Street, New Britain, Connecticut.

CARTER TOOLS



MORGAN VISES *will save you money*

Morgan Vises represent more than a quarter of a century of experience in manufacturing vises. Made of quality materials and exacting workmanship, these vises are ready and able to give the utmost in industry and school shops for wartime service.

MACHINIST VISE
Unsurpassed for strength and durability. Supplied with stationary or swivel base and in various sizes.

CONTINUOUS SCREW AND QUICK ACTION VISE
Designed and built to withstand the most severe service. The extra heavy Cold Rolled Screw and Solid Bronze Nut will last a lifetime.

THE MORGAN VISE CO.
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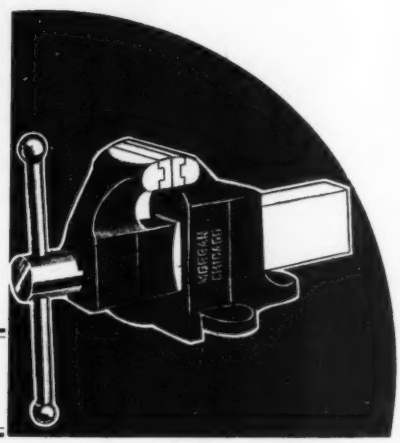

Morgan semi-steel vises give you more years of unbroken, satisfactory service. That is why thousands of school shops throughout the country are using Morgan vises as standard industrial-arts equipment. That is why, too, their shops are more economical and more efficient.

BUILT *for Lifetime Wear*

(Continued from page 22A)

This can be done by mail, and using the facilities of the machinery of the print shop to convey the message to the local industry. The returns on such a promotional campaign will be good. One instance of this type of promotion is the 10 per cent return of Cincinnati's Printing High School mailing: on the day that 400 letters had been sent out, 40 co-ops were employed. None was employed prior to that time. In some states, under the co-op plan, boys may work beginning at the age of 14. All government regulations apply co-op students except unemployment compensation, at least in one state, and probably in many others. Although minimum-wage scales do not usually apply to co-ops, as they are considered students-in-training, the pay runs from 30 to 50 cents per hour to start. This means that young men can feel the jingle of their own money in their pockets, and reap the benefits of practical shop experience and get a high school education at the same time.

The school placement officer or principal or even the individual teacher is in the driver's seat. Why not take advantage of it?

Schools, as well as industry, will have to get along on less paper this year. There will be but 21¼ million tons of paper to satisfy the demands of 25½ million tons. It, therefore, behooves the printing departments of the many schools to conserve paper, and waste not, as we *know* that we shall want. Look over your paper requirements carefully; examine each job of production, and find where saving can be applied. It is said that from 10 to 20 per cent of paper is wasted by industry. This probably is true, and perhaps more in schools. If you do not think so, examine your wastebaskets! Paper used on one side and thrown away; forms too large for the need, margins too big, odd sizes that do not even fit standard files. Those who order printing should look into standard sizes, and examine forms in stock to see if they can be made smaller, made to suit standard sizes, and if they can be printed on lighter stock. In many cases forms can be reduced from 8½ by 11 to 5½ by 8½ in., and 16-pound bond can be used in place of 20- or 24-pound bond. You need make no revisions on colors, provided that you have standard colors. But — as many as 1150 items of color, weight, and size will be dropped from the present 1271! Likewise colored ink will be drastically reduced — on yellow alone we have at present 85 hues and kinds. This will be reduced to three! Digging into the middle of a can of ink will have to be stopped, as it is a terrific waste even when war clouds do not threaten. Frequent wash-ups should be eliminated.

An interesting lesson may be conducted on where our graphic-arts metals are found: lead, tin, antimony, copper, and zinc. It can be pointed out just how the Far Eastern condition may affect printers and lithographers. It is assumed that we shall have sufficient of these metals to carry us through — but we are not sure. Look carefully to your waste in type — you may have a hard time getting more!

The Pupil-Personnel Shop Organization

G. H. SILVIUS*

The idea of using student help to facilitate the operation of a school shop or laboratory is not a new one. The practice of using students to help check tools, cut and store stock, clean and paint the benches and machines, has been used by most shop teachers. A formal schedule to bring students into an orderly directed program has been called a pupil-personnel organization.

The experiences of teachers have shown that the student-personnel organization functions equally well on all grade levels in the industrial-arts subjects. A careful study of successful plans for developing and using such an organization has shown that certain practices are more or less basic.

*Public Schools, Detroit, Mich.

Install DeVilbiss

BE SURE YOUR STUDENTS ARE TRAINED WITH THE SAME EQUIPMENT THEY WILL USE WHEN THEY GO INTO INDUSTRY

Spray-Painting Equipment for Sheet Metal, Woodworking, Ceramics, Electrical, Radio, Automobile and Aeronautics Shops.

Small Spray Units for Poster, Art and Crafts work.

Offset Prevention Equipment for the Print Shop.

Automotive Service Equipment for cleaning, washing, dusting, and lubrication.

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Write for your copy of "The ABC of Spray Painting"—*FREE*

THE DeVILBISS COMPANY • TOLEDO, OHIO
Canadian Plant: WINDSOR, ONTARIO

DeVILBISS SPRAY SYSTEMS

(Continued from page 24A)

A Shop Organization at Work

A visitor in a typical school shop operating with a student-personnel organization would be conscious of an orderly businesslike attitude on the part of the students. If the visitor was in the shop while the students were coming in, he would notice that one of them would immediately get the keys and start opening the lockers, while the other students would remove their outer garments and put on their aprons. He would also notice that some of the students would don aprons on which names were placed, such as superintendent, toolman, and foreman. In a short time most of the students would be at their work stations, the workbooks would be opened, and the projects on which they were to work would be placed on their benches. Some of the students would be getting their tools from the student officer stationed in the toolroom. While the students are entering, the teacher stands near the entrance of the shop. After the bell has been rung, indicating the beginning of the class period, the student superintendent calls the class to order. He asks the record clerk to check the attendance and to read the names of those who are absent. This all proceeds quickly and quietly because the class cooperates. Then the superintendent calls upon the safety engineer to conduct the safety inspection. The safety engineer moves about the shop looking for any student who has neglected to remove his outer garments, put on his shop apron, or who has failed to tuck in his tie and roll his sleeves above the elbows. After this brief inspection he reports, "All boys have passed the safety inspection."

The superintendent conducts the program

The toolman is then asked to report the missing tools. After his report of "No tools missing," the superintendent then calls upon the teacher who until this time has been observing the class. The teacher uses about five minutes to demonstrate a tool operation.

The superintendent again takes charge of the class after the demonstration and asks the record clerk to read the names of students who may have brought excuses for previous absences. This, too, is all done quickly. The superintendent then sets the class to work. Usually all of the students are at work nine minutes after the tardy bell is rung.

During the work period the teacher moves about the shop helping students that are having difficulty with their manipulative work, marking jobs, and performing other teaching duties. The foremen help students with their problems and inspect their work. One of the officers with the word "Serviceman" on his apron, takes care of such duties as washing the blackboard and cleaning the sink.

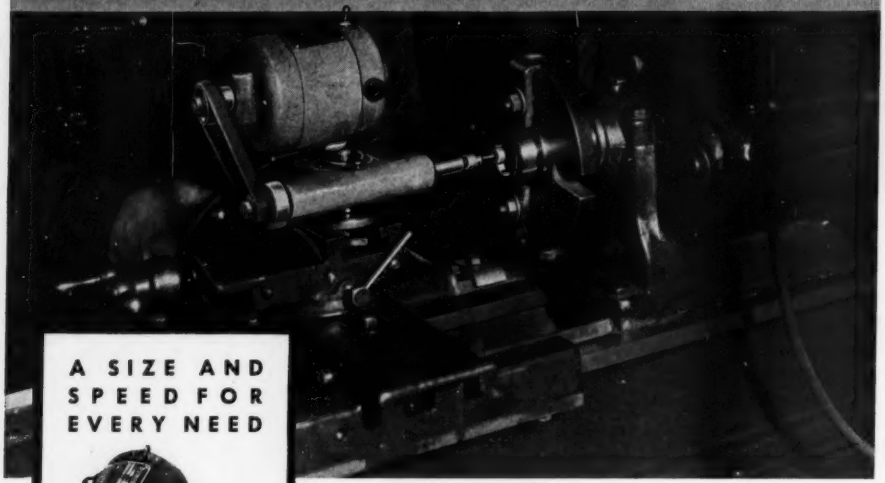
A few minutes before the end of the period the superintendent rings a bell announcing the cleanup period. Each student then cleans his workbench and returns the tools he has used.

(Continued on next page)

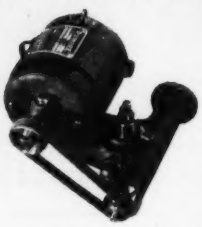
The record clerk checks out the books

1/16 the thickness of a fly's wing!

YOU CAN GRIND THAT ACCURATELY WITH A DUMORE



A SIZE AND SPEED FOR EVERY NEED



Here's the lowest priced Precision grinder on the market . . . the Dumore "Tom Thumb." Has 1/14 h.p. AC-DC motor, with speeds 10,000 to 22,500 R.P.M. Handles wheel diameters 1/8" to 2". Does internal or external work.

Every day precision grinding gains new importance in industry. With this growth comes the demand for highly specialized operators. Industrial schools can use Dumore Grinders to train men in their shop to be ready to meet grinding problems they'll face when they get into the "battle of production." Dumore Grinders can be mounted on a lathe, planer, shaper, milling machine or other machine tool, offering wide-range experience to the student.

More than a quarter-century of precision grinding research is behind each Dumore tool. Call your nearest Dumore distributor today. His help in solving your training equipment problems can be obtained without obligation.

Write for our booklet, "The Care and Operation of Portable Precision Grinders."

THE DUMORE CO., Dept. 232-C, Racine, Wis.

Dumore PRECISION Grinders

The safety engineer keeps the safety bulletins up-to-date

to his work and the other officers working on part-time assignments.

The names used in the personnel organization should conform with those used in industrial shops. The student that is in charge of the organization and the other officers, should be called the superintendent. The title, "foreman," should only be used to designate an officer in charge of a group of workers. To be consistent a boy in charge of the toolcrib should be called a tool boy, crib boy, or better, toolman, but not tool foreman. In the general-shop organization we often find a wood foreman, in charge of the workers in the woodworking area, a metal foreman directing the work of the students in metalwork, and a foreman for each of the other departments.

A foreman in a well-organized shop will be kept busy if he is being of service to twelve students. It is often desirable to have a foreman take charge of two or more departments so that he will have sufficient students. It hardly seems that any teacher would care to maintain a student-personnel organization without a safety engineer. Many teachers have found several duties for a record clerk. Such duties as washing the sink, and dusting the models can be assigned to a serviceman.

(Continued on page 30A)

(Continued from previous page)

In a short time all of the students have put away their workbooks, aprons, unfinished projects, and tools. They then return quietly to their work stations and remain standing there. The superintendent then calls the class to order. He again asks the record clerk to read the names of those marked absent, and O.K.'s the attendance report. The toolman reports that all tools have been returned, after which the superintendent announces the marks which he has given to the various officers. In the minute or so left, the superintendent leads a discussion on possible improvement of the officers' duties and shop conditions. The superintendent then dismisses the class after the passing bell has rung.

Establishing a Student-Personnel Organization

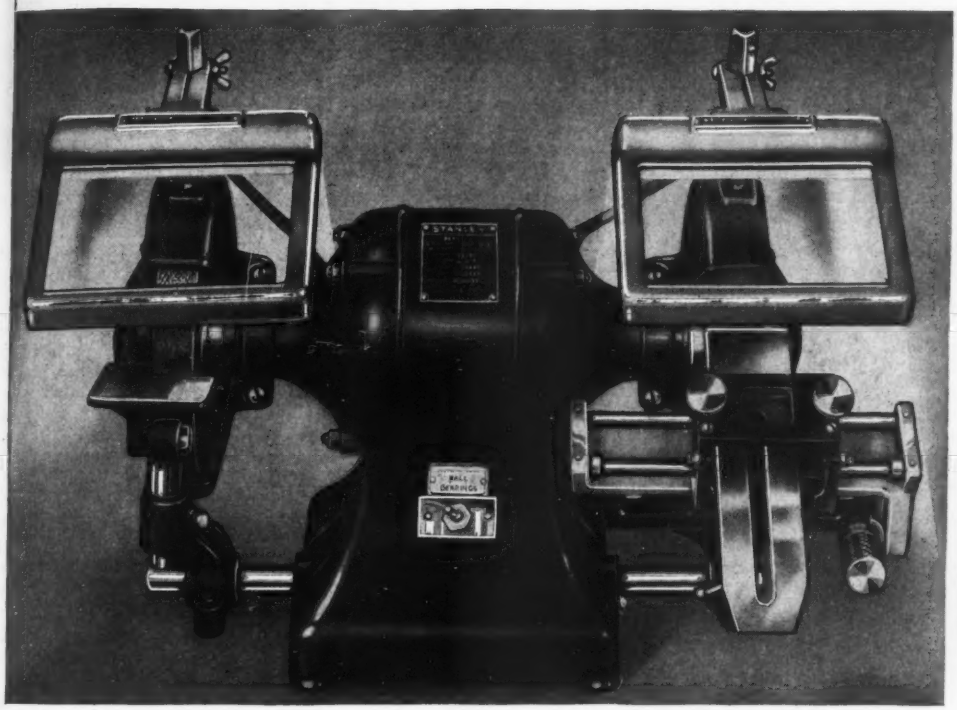
In establishing a student-personnel organization the teacher must decide if the officers are going to devote their full time to their work for a designated period, or if they are going to work part time as officers while they are doing manipulative work. In industrial-arts classes that are composed of more than 40 students, and that meet every day, the plan of having a few officers devote full time to their work for one week has worked successfully. In classes that are smaller in number, the plan of part-time assignments works very well. Several shops have been organized with a superintendent devoting all of his time

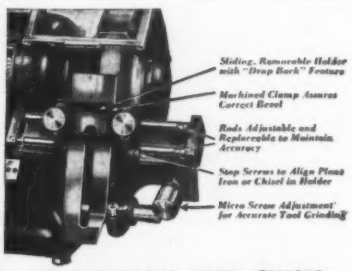
The toolman accepts the responsibility willingly

STANLEY

ELECTRIC TOOLS FOR SCHOOL SHOPS

TRADE STANLEY MARK



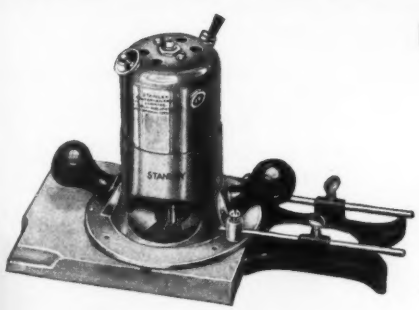

Sliding, Removable Holder with "Drop Back" Feature
Machined Clamp Assures Correct Bevel
Rods Adjustable and Replaceable to Maintain Accuracy
Stop Screws to Align Plane Iron or Chisel in Holder
Micro Screw Adjustment for Accurate Tool Grinding

PLANE IRON AND CHISEL GRINDING FIXTURE

Standard equipment with the No. 677 Grinder, keeps edge tools accurately beveled. Takes plane irons up to 2⅝" wide and chisels of any size. Micro screw feed adjustment.

STANLEY "FLUD-LITE" EYE SHIELD

Effective eye-protection combined with better vision. Two light bulbs with reflectors floodlight work area, help prevent injuries. Adjustable up and down, and tilts to suit operator's position. Cannot be moved to non-guarding position without dismantling. Standard equipment on No. 677 Grinder. Can be attached to all similar bench or belt-driven grinders.



No. 677 EDGE TOOL GRINDER

Every wood-working shop needs this improved, full ball bearing Bench Grinder. Powered by a ⅓ H.P. induction motor, fully enclosed, it operates at the correct speed for edge tool grinding. Equipped with "Flud-Lite" Eye Shields, one Adjustable Tool Rest, and the Plane Iron and Chisel Grinding Fixture.

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Fast – 18,000 R.P.M. – assuring a smooth finish that makes sanding practically unnecessary. For Shaping, Inlay Work, Routing, Templet Work, Veining, Grooving, Rabbeting, Corner Beading, etc. The power unit may also be quickly attached to a Beading and Fluting unit or to a shaper table. Provides a great variety of practical cuts and a wide range of decorative operations at a very low cost.

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Aircraft Sheet Metalwork—*Giachino.* Part I—Text. Concise instructions and all information needed for aircraft sheet metalwork. Part II—The Workbook. 27 typical problems in blueprint. Complete $2.92.

Woodworking Workbook—*Nichols & Stiles.* Preview, study exercises, illustrations, and questions covering: preliminary information, woods, tools, processes, and finishing. Highly acclaimed. 56 cents.

FOR REFERENCE

How to Teach a Trade—*Selvidge.* $1.00.

Individual Instruction Sheets—*Selvidge.* $2.50.

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Electric Motor Work—*Willoughby & Selvidge.* Information and job sheets clearly presenting fundamental theory for both D.C. and A.C. equipment. Treats specific jobs on series, shunt, compound, single and polyphase, motors and generators. Practical and simply stated. $1.76.

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(Continued from page 28A)

It is not necessary to have a serviceman in every class. In the classes that are smaller in number, this job might be eliminated since it is not necessary to do such duties as dust the models each period during the day.

After the names of the officers have been selected, the duties should be determined for each officer. Short direct statements outlining the duties have proved effective. Examples:

Appoint the substitute officers
Take charge of the shop library
Check the attendance
Conduct the safety inspection
Assign work stations
Inspect the work of the students in your group
Take care of the sink
Wash the blackboards

It may be necessary to amplify some of these short statements with an explanatory sentence. For instance:

Enforce the safety-zone rules.

"The lines that have been painted on the floor around the equipment intended for use by one student at a time, mark the safety zone. These serve as an important safety device for eliminating accidents. Your responsibility is to prohibit traffic through these zones. Violators should be referred to the teacher."[1]

After the duties have been written for each officer, it is suggested that a study be conducted of the time required for the officer to do the work that has been assigned. If the teacher was planning to have the superintendent work full time on his job and he found that it took less time than one class period to do the duties, it is obvious that either additional duties should be developed for the superintendent or the job classified as a part-time job.

In writing a duty, care should be taken to co-ordinate the activity with the program as a whole. If, for example, you plan to have a safety inspection at the beginning of the class period, it will be necessary for the superintendent to ask the safety engineer to conduct it at that time. This duty will then appear on the lists for both the superintendent and the safety engineer. In the event it is changed later, it is necessary to correct it in two places.

The officers must be familiar with their duties. The statements describing the duties must, therefore, be written in a way that the average student can understand them because neither the teacher nor the members of the class have sufficient time to discuss the de-

(Continued on page 32A)

Foreman-student relationships. "It ain't square"

[1]Baysinger, Gerald, Silvius, G. H., *Student Planning Book for Industrial Arts* (Scranton, Pa.: International Textbook Co.), pp. 5–10.

The sink is always clean with the serviceman on the job

STUDENTS ARE READY TO STEP INTO *Production*

WHEN TRAINED ON

WALKER-TURNER MACHINE TOOLS

Training on Walker-Turner Machine Tools gives beginners a preview of actual industrial production. These modern-design, compact machines are setting a new trend in industry for speeding up lighter operations. Thousands are operating throughout the very War industries whose production lines are waiting to absorb these newly trained workers.

Walker-Turner Machine Tools are easy and safe to handle—accurate in operation. Instruction is simplified; thorough, practical skill is acquired more quickly. Correctly engineered—sturdily constructed, these machines stand up under 24-hour, 7-day schedules, with minimum maintenance. Their low cost permits you to enlarge facilities and train more men, within your present budget. And, vitally important, prompt shipment can be made for War training programs.

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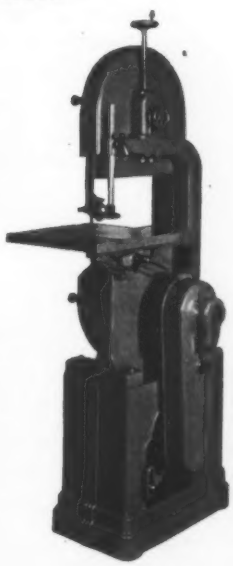
For shaping wood, plastics, aluminum and other metals. Also accessories for sanding, dadoing, tenoning, reeding, fluting, etc. Geared motor operates spindle at 7600 r.p.m. Reversing switches operate cutters either direction. Vernier elevating control. Fully safeguarded.



BAND SAWS (right)
14" and 16" models. Backgearing and cone pulley provide speed range from 61 to 5300 s.f.m., for cutting practically any material from tool steel to wood.

(left) RADIAL DRILL
Handles many light drilling, tapping, routing and profiling operations as effectively as larger machines which cost 5 to 6 times as much. Drills to center of 62" circle. Maximum distance nose of chuck to table 13½". Spindle traverse 3¾".

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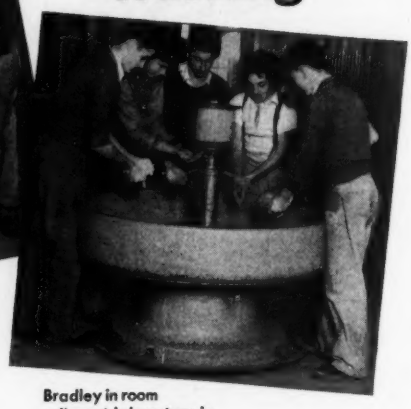
SPINDLE SHAPERS · GRINDERS · FLEXIBLE SHAFT MACHINES · CUSTOM BUILT MOTORS

Safe, Clean Washing

One of three Bradley Washfountains in shop section McClymonds H. S., Oakland.



Bradley in room adjacent laboratory in Albany, Calif., H. S.

Sanitary Group Wash Fixtures Guard Health of Students

Economical to install and maintain, Bradley Washfountains provide washing facilities that insure maximum sanitation. Eight to 10 may wash simultaneously, each served fresh, clean running water from a central sprayhead. One Bradley takes the place of 8 to 10 single-person wash basins and thus reduces piping connections by 80 to 90 per cent. The generously proportioned deep bowl is self-flushing to eliminate collection of water and possible contamination.

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BRADLEY washfountains

(Continued from page 30A)

tails. If the officers understand their duties, then it is only necessary for the teacher to take sufficient class time to explain the general plan. If the students are encouraged to suggest extra duties, additions may be made to the lists that are being used. Many teachers are succesful in having the students write the duties for the serviceman since the physical conditions in each shop determine the duties that deal with service work.

It is essential that the teacher devise a plan for giving credit for performing student-personnel work. Credit for the work done should be based on the time it takes an average boy to do the assigned duties and on how well he has done them. Many teachers have the superintendent read the marks for the officers at the end of the class period. At the end of the term of office it is recommended that the marks be placed on the same cumulative records as the marks for the manipulative work, for the students must feel that the personnel work is just as important as the manipulative work. Another reason for evaluating the work of the officers is to stimulate better performance.

The question is often asked, "How far can the teacher go in delegating responsibilities to student officers?" The teacher should do the work that the students cannot do successfully. Even with an extensive student-personnel plan it still remains for the teacher to do such things as giving demonstrations, presenting the instruction, assigning students to departments, approving of the final evaluation of a completed job, and providing for remedial instruction.

It is hoped that the material presented herewith, will be helpful to those who are working with, or plan to establish a student-personnel organization.

SAFETY AND THE SHOP TEACHERS

Richard M. Bell*

In some states there is a ruling in effect that no local board of education may be held legally responsible for any accidents of whatsoever nature to any student. This position automatically places the burden of responsibility on the teachers and principals. They can be and are being held legally responsible for children under their direction and if a judgment be reobtained against them even their salary could be garnisheed. This state of affairs has led many teachers to pay insurance premiums on group or personal policies in order that they may have protection.

Where Do You Stand?

If you do not know your own position in your own state you should ascertain it now before it is too late.

What is your responsibility if you allow any boy in your class to run any machine the boy's work might require. Such a situation is eventually going to be disastrous not only for the teacher involved but to a lesser degree to all industrial-arts teachers.

The following suggestions represent a minimum of what every shop teacher should do.

1. Adequately instruct all students in *machine safety* and in the use of machinery before they are permitted to use a machine.

2. Require a written permission slip from the parents before the student is allowed to touch any machine. This will make the parents cognizant of hazards and at the same time, the letter should be worded as to release the teacher from any responsibility other than normal care and supervision.

3. Permit the student to operate a machine only upon personal permission of the instructor at the time of operation; that permission to be in force only for that operation, on that day and in that period. Said permission being incumbent upon careful, sensible, and serious operation of the machine in question.

4. The student may operate a machine only after passing a test for that machine. See the accompanying band-saw test. In some schools a permission card is issued to operate a machine and the operator must expose his card prominently while operating the machine. This card is immediately recalled if the operator violates any of the rules of safety in regard to that machine. Many safety bulletins and suggestions have been published in this magazine and these should be read and displayed. Some cardinal safety rules ap-

(Continued on page 35A)

*Leonia, N. J.

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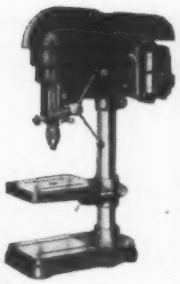
FOR MODERNIZING AND EXPANDING YOUR SHOP
Besides THIS FAMOUS HELMET-HEAD DRILL PRESS



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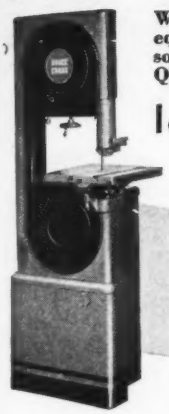

When emergency training of pattern makers and skilled workers skyrockets the need for shop equipment, Boice-Crane can help you. With these very same Boice-Crane tools, industry has already solved many similar problems. Faced with the need for more modern and greatly enlarged facilities QUICKLY, you should get the details of these unusual light machines.

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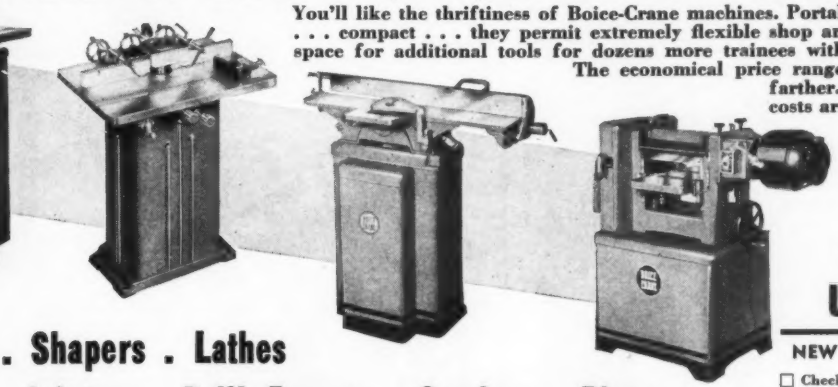
You'll like the thriftiness of Boice-Crane machines. Portable . . . trimmed of excess weight . . . compact . . . they permit extremely flexible shop arrangement. You can actually find space for additional tools for dozens more trainees without adding a foot to your shop. The economical price range spreads program budgets much farther. Operating and maintenance costs are way down.



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(Continued from page 32A)

plicable to all shops and all machines should be continually stressed by the teacher. A few of these follow:

Think First; You May Not Be Able to Think Later
Consider the Other Fellow That He May Consider You and Yours
Talking While Operating a Machine Is Like Sleeping at the Wheel — Dangerous
Adjust All Machines with Power Off and Machine Idle
Have a Clear, Nonskid, Working Floor Space at Every Machine
Glasses Are Easier to Replace Than Eyes
Clear the Working Bed or Table of Every Machine Before Starting It
Shop Activities Do Not Include Wrestling and Horseplay

The instructor may know of other statements like those given. Make use of them.

The following three instruction sheets on the care and operation of the band saw are first given to the student.

Sheet No. 1. — Safety in Operating a Band Saw

PURPOSE: To inform the band-sawyer of the common causes of accidents in the operation of a band saw, so that he may guard himself and others against them.

Common Causes of Accidents to the Band-Sawyer.

1. Using the fingers, instead of a stick, to clear away scraps.
2. Using the fingers, instead of a stick, to finish a cut through narrow stock, or to finish a resawing cut.
3. Trying to saw such small pieces that one little slip would mean the loss of a finger or two.
4. Causing the saw to slip off the wheel or break, by:

a) Not *first* making the proper adjustments;

b) By backing too quickly out of short, straight, or curved cuts;

c) By trying to back out of long ripping or resawing cuts *without stopping the saw;*

d) By using a dull saw;

e) By trying to saw stock which will not lie level and which may twist or pinch the saw.

5. Cutting round stock, or overhanging stock, which may cause a sudden forward roll, and draw the hand into the saw, or cause the saw to break.
6. Spreading out the fingers of each hand, instead of grouping them together so that they may be more easily watched.
7. Talking or glancing away from the cutting edge for a fraction of a second, may cause a very serious accident.
8. Another person standing within the safety lines or passing near may accidently bump the arm of the sawyer, and easily cause serious injury; therefore, stay outside the safety lines, and be extremely careful in passing the band saw, when someone is using it.

The *observer* who is watching a band-sawyer should not stand in line with the revolving saw on the right side of the table. If the saw should break, it will fly in this direction.

Sheet No. 2. — To Operate and Adjust a Band Saw

Purpose: To learn how a band-sawyer safely operates and adjusts a band saw for scroll sawing.

Tools and Materials: Band saw, stock laid out for scroll sawing.

Procedure: Know Information Sheet No. 1.

Read: Disston, "Tool Manual for School Shops," pp. 57–69.

1. As a safety measure, pull the main band-saw switch or connection.
2. Locate the following parts by means of a chart: frame, table, table-tilting device, wheels, guidepost, upper and lower guides, motor, saw, saw-tension adjusting wheel, pivot device for tilting upper wheel.
3. *The following items must be checked each time before starting the band saw:*

a) The table should be level, and clear of tools and cuttings.

b) There should be no scraps under foot within the safety lines.

c) The guide should be set so that it just clears the stock.

d) The tension arm should show that the saw is adjusted to the proper tension.

e) Revolving the machine by hand should show that the saw is not fouled, that the saw blade is in both guides, and that the saw blade is just touching the guide wheels.

4. *Abuses* of the band saw to be avoided are:

(Continued on page 38A)

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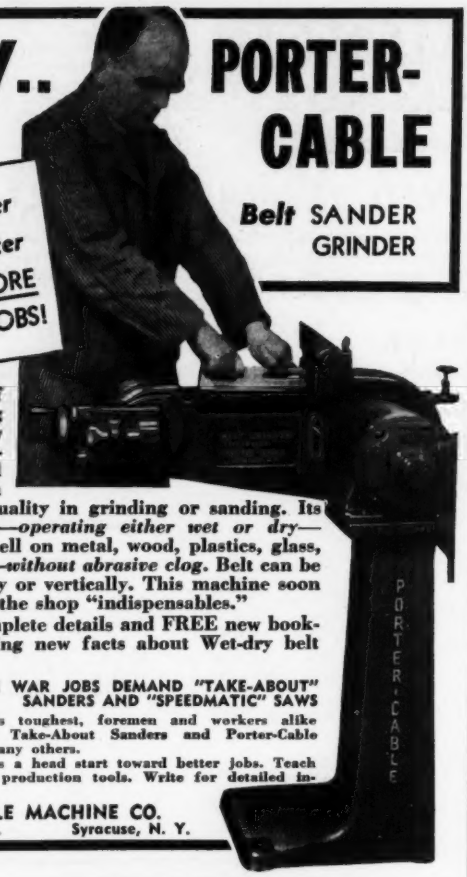

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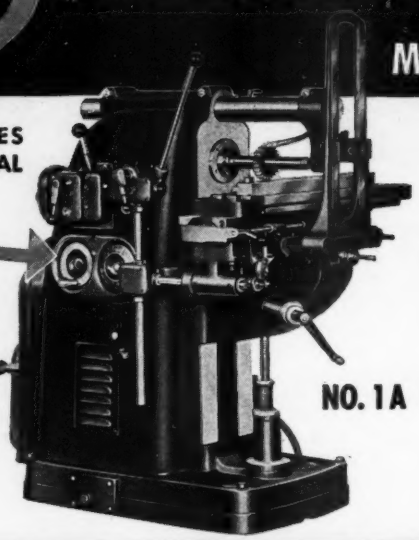
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LATHES · TURRET LATHES · MILLERS · BORING MACHINES

(Continued from page 35A)

a) Starting the saw into the cut before it has picked up speed, or after the power has been turned off.

b) Forcing the saw to make too sharp a curve for its width.

c) Forcing the saw at too fast a feed, or with too heavy a cut.

d) Forcing the work against the side of the saw in trying to make it cut to a line.

e) Backing out of a long cut while the saw is running.

f) Making adjustments while the saw is running.

g) Placing too much or not enough tension on the saw blade.

h) Allowing the saw to ride too hard against the guide wheels or against the jaws of the guide.

i) Sawing material with gravel, nails, or other hard substance in it.

5. Check over Information Sheet No. 1, "Safety in Operating a Band Saw," and be ready to ask instructor to clear up any points on safety which you do not understand.

6. Instructor will watch while you go through the following steps, sawing to a straight and a curved line.

a) Check items: (*a*), (*b*), (*c*), (*d*), and (*e*) under Number 4.

b) Saw slowly and attempt to split the line all the time, avoiding abuses as noted under Number 5, and following all safety rules mentioned on Sheet No. 1.

Sheet No. 3. — To Remove, Coil, and Replace a Band-Saw Blade

PURPOSE: To learn the more difficult operations of adjustment required of a bandsawyer.

PROCEDURE: Learn and know how bandsaw blades are ordered and supplied.

1. As a safety measure, pull the main bandsaw switch or connection.

2. Release the tension on the upper wheel, which will loosen the saw.

3. Open the wheel guards, and take off the saw blade.

4. Follow these steps to coil up a saw in three loops:

a) Turn the teeth of the saw away from you.

b) Hold the bottom down with the toe of your shoe.

c) Grasp the saw near the upper third, with a hand on each side.

d) Hold it between thumb and two fingers of each hand, with the thumbs on the outside.

e) Turn the thumbs in, and at the same time cause the top of the saw to loop over and rest on the toe of your shoe.

f) Still holding onto the saw, cross the right hand under the left, and saw will fall into three coils.

5. Uncoil the saw blade to be placed on the band saw, watching to see that it does not cut you, or someone near you, as it uncoils:

6. Hang the saw at about the center of the top wheel, making sure that the teeth are pointing down on the guide side. If the teeth point up, remove, and turn the saw inside out.

7. Enter saw in both guides, and set the upper guide wheel so that the gullets of the teeth are about 1/16 in. on the outside of the jaws.

8. Slip the saw on the lower wheel, and draw up the tension until the saw is freed of any sag. Another half turn of the tension-adjusting wheel will usually be sufficient for a narrow saw. Saws ¾ to 1 in. wide require more adjustment.

9. Adjust the pivot device for the upper wheel until the back of the saw rides very lightly on the upper guide wheel when the saw is revolved several times by hand.

10. Adjust the lower guide wheel so that it turns with the upper guide wheel when the saw is revolved by hand.

11. Have the machine inspected by the instructor or foreman *before* testing it under its own power.

After the student has studied these lessons, the instructor gives a working demonstration on the machine to illustrate the information on the sheets. After a sufficient time has elapsed for the student to study the material the test is given. The written test, if passed, is followed by a performance test on the machine. The student who has passed the tests and has his parents' permission is allowed to use the machine under the conditions previously outlined.

Sheet No. 4. — The Band-Saw Test

In order to be eligible to operate the band saw in this school you must know the answers to the following questions.

In the places provided, place an *R* if you think that the statement is *right* and a *W* if you think the statement is *wrong*.

1. —— The guards must always be kept in the closed position.
2. —— The upper wheel is adjustable vertically.
3. —— The saw should be inspected and run by hand before using.
4. —— The lower wheel is adjustable horizontally.

(Continued on page 41A)

(Continued from page 38A)

5. —— The guide should be adjusted by hand.
6. —— The wheel is tilted to make the blade the right tension.
7. —— The table must be tilted before the machine is started.
8. —— The teeth of the saw blade should project beyond the guide rollers about ¼ in. in order to work properly.
9. —— Use as heavy a blade as the nature of the work will allow.
10. —— The teeth on the cutting side of the blade should point toward the floor.
11. —— Adjust the guidepost to the top of the work before starting the saw.
12. —— You may feed the wood against the saw as fast as you wish.
13. —— Cut out through the waste if possible instead of withdrawing the stock.
14. —— The working line should be kept visible.
15. —— The more set a saw blade has the more smooth the cut.
16. —— The more set a saw blade has the easier it will be to cut curves.
17. —— Warped stock should not be cut with the machine because it might twist or break a hand saw.
18. —— To coil a band-saw blade the teeth should be turned toward one's body.
19. —— The thumbs should be on the outside when coiling the saw.
20. —— The right hand should cross under the left in order to complete the coils.

Complete the Meanings by Filling in All Blanks

1. Abuses of the band saw to be avoided are:

a) .....
b) .....
c) .....
d) .....
e) .....

Key

Starting to cut before inspecting for nails, or before the saw has picked up speed, or after the power has been shut off.
Forcing saw to make too sharp a curve.
Forcing saw with too fast a feed or too heavy a cut.
Forcing work against side of saw, guides, or wheels.
Making adjustments or hurrying back out of cuts with saw running.

2. Before starting the band saw the following items should be checked:

a) .....
b) .....
c) .....
d) .....
e) .....

Key

Table is level and clear.
Floor is clear and not slippery.
Guide is set to clear stock by ¼ in.
Saw blade is adjusted to proper tension.
Revolving machine by hand to see that saw is not fouled, and that saw blade is in both guides and not quite touching the guide wheels.

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Journal of Adult Education

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Similar observations may be made in the metalworking shop. An attempt to force a sheet of brass or aluminum into the shape of

*Assistant Superintendent of Schools, Minneapolis, Minn.

(Continued on page 46A)

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — teacher's, and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¼- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking—Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, 1/3 pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/8 in. and 5/8 in.
- b) Cold, 5/8 in. and 3/4 in.
- c) Diamond point, 3/8 in. and 1/2 in.
- d) Roundnose, 3/8 in. and 1/2 in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes

COMBINATION SQUARES—with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting
DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to 1/2 in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to 1/2 in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, 1/2 in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple, for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.
- b) Blades, power, 14T, 12 in.
- c) Frames, adjustable

HAMMERS
- a) Babbitt
- b) Ball peen, 13 oz., 16 oz., or 20 oz.
- c) Blacksmith's, various kinds
- d) Riveting, 9 oz., and 12 oz.
- e) Setting

INDICATOR
- a) Center
- b) Universal or universal dial test
- c) Speed

KNURLING TOOL — with assorted knurls
LADLES
- a) Bull
- b) Hand bowls
- c) Melting

LATHE DOGS — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

(Continued on page 44A)

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Board of Education - San Francisco
Santa Ana High School - Santa Ana

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CONNECTICUT
State Trade School - Stamford

ILLINOIS
State Teachers College - Charleston
University of Chicago - Chicago
Englewood High School - Chicago
Washburne App. School - Chicago
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Purdue University - Lafayette
Vocational Education Dept. - South Bend
Gerstmeyer Tech. High School - Terre Haute
Indiana State Normal - Terre Haute

IOWA
Iowa State College - Ames
Davenport Public Schools - Davenport

KANSAS
Labette County Community High School - Altamont
Kansas State Agricultural College - Manhattan
Topeka Public Schools - Topeka
Wichita High School - Wichita

KENTUCKY
Theo. Ahrens Trade School - Louisville

MASSACHUSETTS
Beverly High School - Beverly
Brookline Manual Training - Brookline
Mass. Institute of Technology - Cambridge
East Boston High School - East Boston
Holyoke High School - Holyoke
Hyde Park High School - Hyde Park
Lawrence Industrial School - Lawrence
Vocational School - Medford

MICHIGAN
Harrison Park School - Grand Rapids
Union High School - Grand Rapids
Copernicus Jr. High School - Hamtramck
Hamtramck Vocational School - Hamtramck
Jackson High School - Jackson
Central High School - Kalamazoo
Western State Teachers College - Kalamazoo
Boys Vocational School - Lansing
Michigan State College - East Lansing
Wilson School - Muskegon

MINNESOTA
School District No. 12 - Ely

MISSOURI
Manual High & Vocational High - Kansas City
Cleveland High School - St. Louis

NEW HAMPSHIRE
New Hampshire College of Agriculture - Durham
University of New Hampshire - Durham
West Side High School - Manchester

NEW JERSEY
Boys Vocational School - Bloomfield
Central High School - Trenton
Rutgers University - New Brunswick

NEW YORK
New Technical High School - Auburn
Union Free School District - Batavia
North Senior High School - Binghamton
Peckham Vocational School - Buffalo
McKinley Vocational School - Buffalo
Vocational School No. 10 - Dunkirk
Board of Education - Hastings upon Hudson
State Agricultural School - Industry
Jamaica Continuation School - Jamaica, L. I.
Newton High School - Long Island City
Masena High School - Masena
Textile High School - New York
Queens College - New York
Auburn High School - New York
Bronx Vocational School - New York
Franklin K. Lane High School - New York
Geo. Hall Trade School - Ogdensburg
University of Rochester - Rochester
Rochester Shop School - Rochester
Saranac Lake Public School - Saranac Lake
Staten Island Vocational School - Staten Island
Continuation School - Syracuse

LOUISIANA
Sullivan Memorial Trade School - New Orlean

NORTH CAROLINA
University of North Carolina - Chapel Hi
Duke University - Durha

OHIO
Timken Foundation of Canto

OREGON
Jefferson High School - Portland

PENNSYLVANIA
Allentown High School - Allentown
Lower Merion High School - Ardmore
Bethlehem Trade School - Bethlehem
Liberty High School - Bethlehem
State Teachers College - California
Vocational Machine Shop - Clairton
Erie East Technical High School - Erie
Ridley Township High School - Folsom
Franklin High School - Franklin
McCaskey High School - Lancaster
Benjamin Franklin Jr. High School - New Castle
New Castle Trade School - New Castle
New Kensington High School - New Kensington
Arnold Public School - New Kensington
Bok Vocational School - Philadelphia
Dobbins Vocational School - Philadelphia
Girard College - Philadelphia
Hill School - Pottstown
Reading High School - Reading
Pennsylvania State Coll... - College
G.A.R. High School - Wilkes-Barre
E. L. Meyers High Sch... - Wilkes-Barre
Wilmerding School Dis... - ...erding

TENNESSEE
Crocket Technical

VIRGINIA
John Marshall

WEST VIR...
Stonewall
Huntingto...
West Virg...

WASHIN...
Seattle-Ed...

WISCON...
Beloit Voc...
Fond du L...
Green Bay...
Janesville...
Kaukaun...
Ke...
W...
Milw...
Neen...
Shebo...
Two ...
and A...
Wausau ...

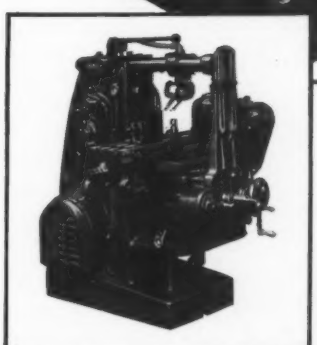
MODERN DESIGN... BUILT-IN SAFETY

MILWAUKEE Milling Machines have won wide acceptance among leading educational institutions—they are preferred by most technical and vocational schools and colleges.

Milwaukee Milling Machines offer many advantages for classroom work: safe for the most inexperienced operators —centralized controls with built-in safety interlocking make it impossible to throw in power controls when hand controls are engaged — low in height — plus many other features of advanced design usually found only in larger machines.

Technical instructors are invited to avail themselves of catalogs, bulletins, framed wall photos, speed charts, and other material — sent, without obligation, upon your request. Write for bulletin No. 725 and special literature.

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis.

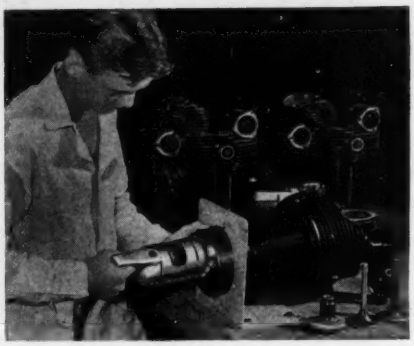


Model 1-H and 2-HL, Universal Type Finger-touch safety controls . . . the famous K&T Double Over-arms . . . directional feed levers . . . plus other perfected features.

Model 1-H and 2-HL, Plain Type Compact, complete . . . with all tried and tested features usually found only in large machines . . . low in height . . . minimum floor space . . . full back column . . . centralized controls.

Milwaukee MILLING MACHINES

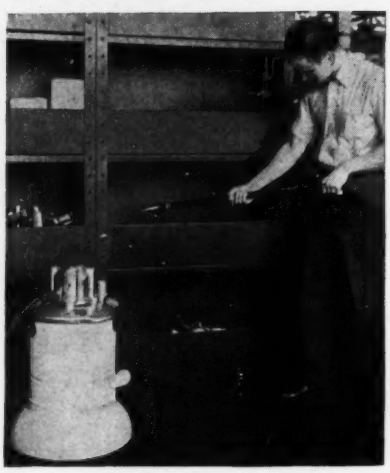
STUDENTS USE THEM



VIBRO-CENTRIC Valve Seat Grinder being used by a student to learn aircraft valve reconditioning. For the past 9 years this has been accepted as the standard precision method.

When students use Black & Decker Portable Electric Tools, they are learning with the same tools actually used for industrial production, automotive servicing and plant maintenance. You can equip your vocational shops with selections from over 100 different types of Black & Decker Electric Tools, for drilling, sawing, grinding, sanding, nut running and screw driving operations. These applications cover every National Defense, Vocational teaching need.

SCHOOLS USE THEM



B & D VACKAR Portable Electric Vacuum Cleaner instantly removes dirt and dust from tool bins, floors, walls—salvages rivets, chips, shavings and other waste material.

Black & Decker Electric Tools are widely used by schools to lower maintenance costs. Black & Decker Electric Drills, Saws and Sanders give quicker and better repairs. Black & Decker VACKAR Vacuum Cleaner speedily and efficiently picks up rivets, chips, cleans floors and walls. Your jobber can demonstrate the exact type and capacity Black & Decker Electric Tool best adapted to your own institution—or write for free catalog to: The Black & Decker Mfg. Co., 780 Pennsylvania Avenue, Towson, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker PORTABLE ELECTRIC TOOLS

(Continued from page 42A)

LEGGINGS — fireproofed duck, to protect students when pouring in foundry
LEVEL — 6-in. bench
LIFTING SCREWS — for molders
MALLETS — wood or soft
MANDRELS — selected sizes
MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.
MOLDING BOARDS
MOLDING STICKS AND TROWELS — various kinds
NIPPERS — end cutting, 5 in.
OIL STORAGE TANK — with pump
OILSTONES — medium and fine
PAILS — galvanized, 12-qt. capacity for foundry
PARALLELS
a) Adjustable
b) Steel, assorted sizes
PLIERS
a) Combination, 6 in.
b) Side-cutting, 6 in.
PUNCHES
a) Center, ¼ in. and ⅜ in.
b) Hollow, ½ in., ¾ in., and 1 in.
c) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
d) Prick, ¼ in.
RAMMERS — for foundry
a) Hand
b) Floor
REAMERS — various sizes
a) Adjustable
b) Hand
c) Taper pin
d) With taper shank
RIDDLES — ¼-in. and ⅛-in. mesh, 18-in. diameter, for foundry
RIVET SETS — assorted sizes
SCALES
a) Steel, 6 in., graduated 1/64 in. to ⅛ in.
b) Steel, 12 in., graduated to 32nds
SCREW DRIVERS — 6 in. and 9 in. blade
SCRIBERS
SHOVELS
a) Coke
b) Sand
SNIPS — tin, 3 in. straight and 3 in. curved
SOCKETS — for taper shanks, drill and tools, selected sizes
SOLDERING COPPERS AND HANDLES — 1-lb. size
SPRAY CAN — for molders
SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry
SPRUE PICKS — for molders
SQUARES
a) Machinist's, 6 in.
b) Blacksmith's
STEEL FIGURES, ⅛ in.
STEEL LETTERS — ⅛ in.
SWABS — for molders
TAPELINE — steel, 25 ft.
TAPS AND DIES
a) Machine screws
b) Pipe
c) N.F. ¼ in. to ¾ in.
d) N.C. ¼ in. to ¾ in.
TONGS
a) Blacksmith's, various kinds
b) Pick up, for foundry
c) Shake out, for foundry
TOOL HOLDERS
a) Boring tools
b) Cutting-off tools
c) Planer
d) R.H. and L.H. offset shank
e) Shaper
f) Slotter
g) Straight shank
h) Threading
TOOL-HOLDER BITS — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.
TRAMMEL POINTS
V BLOCKS AND CLAMPS
WHEEL DRESSER
WRENCHES
a) Adjustable, 8 in. and 10 in.
b) Pipe, 8 in. and 12 in.
c) Tap, adjustable, various sizes

Metalworking— Materials and Supplies

ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide
ABRASIVE WHEELS
ACETYLENE GAS — in drums for welding
ALUMINUM
a) Pigs for foundry
b) Sheets, tubing, rounds, shapes, wire, etc.
BABBITT METAL
BEARING BLUE
BELT DRESSING
BELT LACING MATERIAL
BELT LEATHER
BOLTS
a) Carriage, selected sizes
b) Lag, selected sizes
c) Machine, selected sizes
d) N.F., selected sizes
e) Stove, flat or roundheads, selected sizes
BRASS
a) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
b) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
c) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes
d) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
e) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
f) Wire, soft, 8, 11, and 14 American gauge, selected sizes
g) Wire, spring, 8 to 22 American gauge, selected sizes
CASEHARDENING COMPOUNDS
CHAPLETS — single and double head
COAL
a) Charcoal for foundry or forge
b) Coke for foundry
c) Forge
COPPER
a) Pigs, for casting alloys
b) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
c) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
d) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼, ½, and 1 lb. spools, sizes 16 to

(Continued on page 46A)

4 Rules every school shop student should know *before taking a Wartime Job!*

SKILL in using tools isn't all it takes to make a good wartime worker. He must also know how to make his tools last longer and how to conserve vital materials. That's the stamp of the really skilled craftsman.

So make sure *your* students know the 4 fundamental rules—for getting more service from grinding wheels. You'll be giving industry better workers if you do and you'll be making an *extra* contribution to the war effort yourself.

RULE 1 MAKE SURE OF USING THE RIGHT WHEEL FOR EVERY JOB. Grinding wheels are made to close tolerances of grit size, bond structure, grading and, consequently, performance. A wheel accurately fitted for a given job will last longer and do better work for less money.

RULE 2 MAKE SURE THAT GRINDING SET-UP ON EVERY JOB IS RIGHT. Manufacturers' recommendations on wheel speed, coolant, wheel traverse, grinding pressures etc. should be carefully followed. Correct balance of these factors is important in order to realize the full advantages of properly specified wheels.

RULE 3 MAKE SURE EACH GRINDING WHEEL IS CORRECTLY MOUNTED. Mounting is extremely important in grinding wheel life and operation. It must be carefully done to make sure the wheel is in perfect balance and runs true. If your students have difficulty doing this, we will be glad to send you detailed instructions.

RULE 4 MAKE SURE EACH GRINDING MACHINE IS IN GOOD CONDITION. Bearings should be snug, foundations firm. The frequent inspections and careful servicing necessary to keep a grinding machine in tiptop condition will be paid for many times over in longer wheel life, better work and higher production.

THE CARBORUNDUM COMPANY

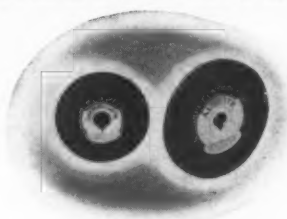
REG. U. S. PAT. OFF.

Niagara Falls, N. Y.

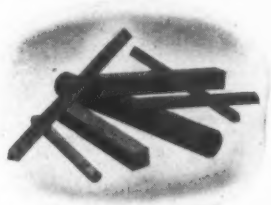
Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

Don't forget, either, that it's a big help to students to learn with the tools that industry uses. In addition to grinding wheels, the other three Carborundum Brand products illustrated below are also in demand where abrasive materials are needed. Write us for details.

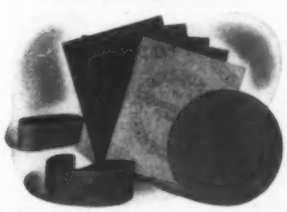


GENERAL PURPOSE WHEELS



MACHINISTS' STICKS

METAL FINISHING CLOTH



COATED ABRASIVES FOR WOODWORKING

CARBORUNDUM
ABRASIVE PRODUCTS

The Truth The Whole Truth

and nothing but the truth!

★

Here's the kind of letter we like to quote. It was written by

MR. E. CARLYLE LYNCH, JR.
Industrial Arts Instructor
LEXINGTON HIGH SCHOOL
Lexington, Virginia

and is but another example of the friends that are being developed constantly by the service and satisfaction which Behr-Manning gives at all times.

Our Industrial Arts Department is entering its fourth year only, but since its beginning we have used Behr-Manning Garnet coated abrasives exclusively and ever found them superior products.

It was my privilege to inaugurate the department, and it seems only natural that I would specify the make of abrasives that I personally believe in.

Your brand's toughness of paper, flexibility of adhesive, and unusual sharpness of grit . . . give us an abrasive tool that is a distinct pleasure to use.

We are not only users of your Garnet Papers but of your Metalite Cloth. Until last year we used old-fashioned emery cloth for cutting and polishing, but now that the boys have gotten a chance at Metalite Handy Rolls, we will experience difficulty disposing of the emery cloth.

MR. LYNCH closes as follows:

I have written you only the truth as I know it, and you are at liberty to quote me.

Thank you, MR. LYNCH.

★

BEHR-MANNING, TROY, N.Y.
(DIVISION OF NORTON COMPANY)

(Continued from page 44A)

36, English gauge, selected sizes

CORE
- *a*) Compounds
- *b*) Flour
- *c*) Paste
- *d*) Oil
- *e*) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — Pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
- *a*) Boiled linseed
- *b*) Lubricating
- *c*) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — back asphaltum

PINS
- *a*) Cotter, 3/32-in. to ¼-in. diam. from ½ in. to 2 in. long
- *b*) Flask, for flask repairs
- *c*) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

PUMICE POWDER

RIVETS
- *a*) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
- *b*) Iron, No. 14 gauge to 3/16 in., flathead or button head, ¼ in. to 1 in. long, selected sizes
- *c*) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
- *a*) Molding, in 350-lb. barrels or 800-lb. casks
- *b*) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
- *a*) Flathead or roundhead iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds
- *c*) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
- *a*) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4-ft. lengths, selected sizes
- *b*) Bars, cold rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12-ft. lengths, selected sizes
- *c*) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
- *d*) Rods, hexagon and square, cold rolled, ¼ in. to ¾ in., in 12-ft. lengths, selected sizes
- *e*) Round, cold rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
- *f*) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
- *g*) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
- *h*) Threaded rods, Nos. 6 to 10, in 12-in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
- *a*) Pigs, for casting alloys
- *b*) 1C, 1X, 20 by 48 in.
- *c*) 1XX, 20 by 48 in.

WASHERS AND BURRS
- *a*) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
- *b*) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
- *c*) Brass washers, 3/16 in. to ½ in. by 16ths
- *d*) Iron washers, 3/16 in. to ½ in. by 16ths

WELDING FLUXES

WELDING RODS (all rods come in 24-in. lengths)
- *a*) Brazing, 1/16-in., ⅛-in., and 3/16-in. diameter
- *b*) Cast aluminum, 3/16-in., ¼-in., and 3/8-in. diameter
- *c*) Cast brass, 3/16-in., and ⅛-in. diameter
- *d*) Cast bronze, ¼-in. diameter
- *e*) Cast copper, 3/16-in. and ¼-in. diameter
- *f*) Cast iron, 3/16-in., ¼-in., 5/16-in., and ⅜-in. diameter
- *g*) Low carbon steel, ⅛-in., ¾-in., and ¼-in. diameter

WHITE LEAD — for machine shop

WIRE
- *a*) Annealed, 16 to 34 W and M gauge, selected sizes
- *b*) Coppered market, 5 to 18 W and M gauge, selected sizes
- *c*) Coppered spring, 2 to 18 W and M gauge, selected sizes
- *d*) Galvanized, 5 to 18 W and M gauge, selected sizes
- *e*) Piano, Nos. 2/0 to 36, selected sizes
- *f*) Tinned, 16 to 24 W and M gauge, selected sizes
- *g*) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

ZINC
- *a*) Pigs, for casting alloys
- *b*) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.

THE POWER OF PERSUASION

(Continued from page 41A)

a bowl with one fell stroke results in nothing but a wrinkled mass. The same sheet in a spinning lathe, with pressure applied by the hand of a skilled workman, readily takes the desired form and becomes an article of beauty and utility. The automobile fender or body does not spring into its finished form by being subjected to a single pair of dies, but is coaxed into shape by a succession of changes which accomplish the final result through an effective correlation of effort.

In the equestian realm the colt is transformed from the carefree life of the pasture to the disciplined routine of the harness or saddle by a gradual *breaking-in* process. He is introduced to the leather little by little, and becomes accustomed to it before he is required to pull or bear the load himself. Sudden, erratic, or impatient moves during this

(Continued on page 49A)

(Continued from page 46A)

period of transformation may spoil the horse for life, whereas wisdom and persistent firmness will win him to a life of usefulness.

Likewise in the field of salesmanship real and lasting success is founded upon a well-chosen approach and effective means of persuasion. The attempt to persuade the prospect involves certain so-called selling points. Whether sound or not the clever use of those points may accomplish the immediate result; but if the persuasion is to be lasting every point which has led to it must be fundamentally sound and true. The salesman who uses the "last chance" or "preferred prospect" or "price rise" argument is likely to be using undue force upon his customer. Sound quality and lasting utility are more permanently convincing to the prudent buyer. The customer who is swept away by the sheer force of the salesman, only to later regret his purchase, becomes the embodiment of the old adage: "The man convinced against his will is of the same opinion still," and is a poor prospect for future business.

Internal Transformation

Observations thus briefly sketched indicate some of the vast possibilities for accomplishment under the influence of the human intellect. With machines, with inanimate materials, with animals, and even with other human beings, the effectiveness of the means toward securing the desired results depends upon an understanding of just what means to use and how they operate. With inanimate things, such as machines and metals and chemical compounds, the rules and formulas seem easier to grasp sometimes because the factors involved are usually more easily controlled and less variable. Even in animal life the situations are ordinarily simplified by the fact that under most circumstances animals exhibit their real emotions and reactions and are what they seem. With the exception of the animals and birds who play possum instinctively, it is rarely that an animal, unless he has been trained to do so, can wear what is called a poker face.

Teachers, preachers, salesmen, and politicians are all engaged in trying to transform the thoughts, actions, emotions, or knowledge of human beings or to remold or cultivate their skills and intelligence. All these people understand, more or less perfectly, that there are certain factors or influences which are extremely powerful in the process of persuasion. Primitive man discovered some of them and knew they worked, but did not understand them. Modern man is beginning to use them somewhat scientifically.

One of the chief of these factors is fear. People are persuaded through fear to do many things, or refrain from doing them; to take certain stands or shrink from taking them. Fear of pain may persuade one to be a coward and shrink from danger; fear of losing one's job may persuade him to work harder than he otherwise might, or to use unscrupulous methods if directed to do so by someone in authority; while fear of punishment and fear of death are common deterrents.

Another factor probably as strong and widely existent as fear is the hope of reward. Men are persuaded to risk their money in wagers on problematical outcomes in the hope of great financial reward; many schemes of investment and speculation are developed on the same basis; and the hope of reward in the form of approbation, fame, or happiness becomes the persuasive factor in society, politics, and courtship.

There are two influences which supersede either fear or hope. The first of these is a sense of duty. This sense it is which persuades the soldier, the sailor, the fireman, the policeman, and the courageous statesman to cast aside his fears and his hopes for personal reward and take the action which duty demands. Closely related to a sense of duty is an understanding of what is right. This is not confined to moral questions, but is applicable to any field where an unprejudiced consideration of facts may lead to an intelligent conclusion. It may be anything from deciding what kind of chalk to buy for the classroom to voting for a president.

The persuasive power, like many another great power in the world, may be used alike for good or evil purposes; toward worthy or unworthy ends. Many a person has been dissuaded from wrongdoing by the steady persuasive influence of a true companion or friend. In like manner a person of good intentions may be led into questionable ways or crime through the craftiness, scheming, or evil intent of another. It has been written by the wise poet: "Vice is a monster of such frightful mein that to be hated needs but to

(Continued on page 50A)

For Practical Training and Efficient Use of Available Floor Area

● Lyon Shop Equipment solves many of the problems faced by vocational schools striving to meet the Nation's need for skilled workers. It permits efficient handling of larger classes by making better use of available floor area. It familiarizes students with the type of equipment used in a large percentage of America's leading industrial plants. It encourages orderliness, eliminates confusion between classes and protects valuable tools from loss and damage. Mail coupon today for catalog.

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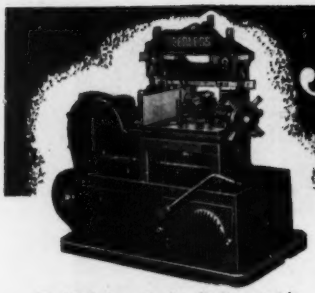
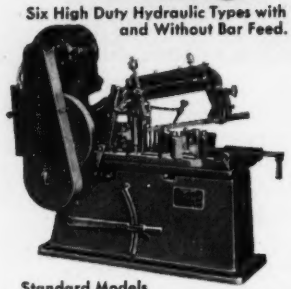


Peerless Metal-Cutting Power Saws

EASY TO OPERATE . . . CUT FAST . . . SAFE . . . AND ACCURATELY

Six High Duty Hydraulic Types with and Without Bar Feed.



Standard Models are Built in Five Sizes for Maintenance and General Utility Cutting.

Peerless Power Saws, both hydraulic and mechanical types, are serving a more vital need today than ever before in defense plants and defense training centers.

Peerless automatic control, including length gauging on the hydraulic types, has won a broad acceptance in plants and schools during the past twenty-five years. High Duty and Universal models have the patented Four-Sided Saw-Frame and Backing-Plate Blade-Support. Other Peerless developments include the introduction of Saws suitable for use with high-speed-steel blades, and a blade coolant system.

There are four bulletins covering the broad Peerless Line — Bulletin 50-A on High Duty Hydraulic types . . . Bulletin 53 on Heavy Duty Hydraulic Saws for die-block work . . . Bulletin 51-A for Universal types with mechanical control . . . and Bulletin 52 covers Standard Models for general utility cutting.

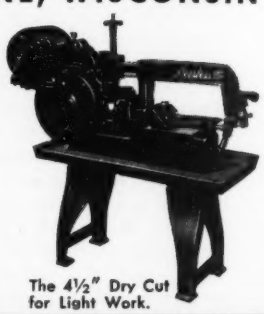
All bulletins sent free on request to Dept. J.

PEERLESS MACHINE COMPANY, RACINE, WISCONSIN

DETAILED SPECIFICATIONS

	*HIGH DUTY (Hydraulic)		UNIVERSAL			STANDARD (3) Sp. Mtr. Dr.			DRY-CUT SINGLE SPEED
SIZES	PLAIN 6½" x 6½"	PLAIN 10" x 10"	6⅜" x 6⅜"	10" x 10"	13" x 13"	6" x 6"	9" x 9"	13" x 16"	4½"
Cap. @ 45° Angle	4" x 6"	6" x 10"		6" x 10"	9" x 13"	4" x 6"	5¾"	10"	
Speeds (3) Strokes Per Min.	60-100 140	50-85 125	50-85 125	50-85 125	50-85 125	50-85 125	50-85 125	50-85 125	75-100
Floor Space	30" x 54"	36" x 57"	24" x 43"	30" x 68"	38" x 75"	21" x 54"	26" x 86"	28" x 102"	16" x 30"
Shipping Weight with Motor	2170 lb.	2930 lb.	1000 lb.	2175 lb.	3200 lb.	1125 lb.	1460 lb.	2110 lb.	250 lb.

*High Duty (hydraulic) Saws also available with automatic Bar Feed.



The 4½" Dry Cut for Light Work.

(Continued from page 49A)

be seen; but seen too oft, familiar with his face, we first endure, then pity, then embrace." An excellent portrayal of persuasion in the wrong direction!

Persuasion in man, as in metal, if it is to be effective must be accompanied with an inner transformation. If this transformation is in the right direction it helps man to stick to standards of ethics, morality, and duty. If it is in the wrong direction, it leads to rationalization and undesirable attitudes toward the realities of life. In any case it strengthens one's belief in the cause for which he strives; therefore let the cause be worthy.

Preserving the Foundations

This power which works within the individual quickly spreads into the group, the family, the school, the city, the state, the nation, and now more strongly than ever before is demanding a place throughout the world. The wisdom of a parent or a teacher is demonstrated by his ability to persuade childhood or youth without the use of autocratic measures. The caliber of a board of education or other board of directors may be judged by the mediums through which they are persuaded to reach their decisions in the adoption of policies, the election of executive personnel, and the conduct of regular business. The strength of a nation depends upon the extent to which its people have been persuaded to believe in the cause for which it stands or strives. Woe to the nation whose leaders have persuaded it to believe in a cause which they know to be false, or to take action which they know to be contrary to the nation's best interests.

When such a leadership has risen, it must be dealt with accordingly lest it cause the downfall of the whole world. Domination or subjugation, be it restricted or widespread, can produce nothing but resentment, despair, and hatred. Evil forces must first be wiped from the face of the earth before the people of the world can again be led to seek that inner transformation which will call forth the creative powers of every nation for the common good of all men.

Answers to Questions

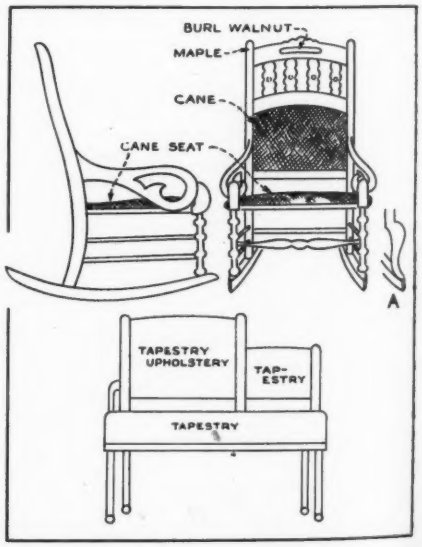
BLEACHING MAHOGANY AND WALNUT

1085. Q.: Can you give me any information on how to bleach wood? We have in mind bleaching a small amount of walnut and mahogany to be used for inlays and for such small objects as chessmen. — *H. C. R.*

A.: Relative to your question on bleaching wood, the M. L. Campbell Co., Kansas City, Mo., furnish a liquid wood bleach and a high-power bleach. The liquid wood bleach is intended for removing stains and refinishing jobs so as to restore the natural color of the wood. The high-power bleach is used to bleach dark woods to a very light color. This firm claims that their bleach will take the color out of walnut, mahogany, and similar woods, and leave it as light as maple. This bleach consists of two liquids which must be mixed when used. It is injurious to the skin and rubber gloves must be worn when using it. This company will, no doubt, be glad to give you further information on their bleaches. — *J. J. M.*

THE QUESTION OF PERIODS

1083. Q.: I am enclosing two sketches, the one of a rocker, the other of a settee. Could you tell me the particular periods to which these pieces belong. Might the rocker be what is known as a Vermont rocker?

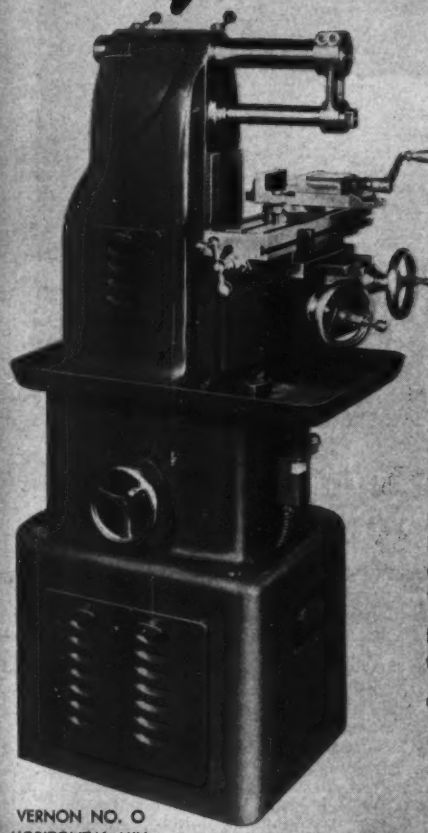


I should like to make needlepoint for covering the old settee. Would this be appropriate for that style?

(Continued on page 52A)

Young America

IS BEING TRAINED ON VERNON TOOLS!



Give your students the advantages of learning on the same machine tools they'll find in industry! All Vernon machines are of highest quality . . . so carefully built they are widely used in the manufacture of today's precision defense equipment —yet all are moderately priced! You'll find The Vernon line is particularly adapted to school use because:

LOW ORIGINAL INVESTMENT means more machines for the same budget—gives every student an opportunity to gain valuable experience.

STURDY, HEAVY-DUTY CONSTRUCTION withstands abuse from new or unskilled students, assures long life of the tool.

HIGH PRECISION tolerances are maintained in manufacture—assuring the user of extremely accurate work. Teaches students to get the most from any machine.

FULLY ENCLOSED DRIVES protect operator from dangerous, old fashioned open belts.

COMPACT DESIGN permits more equipment to be placed on a limited floor area—saves valuable space for all necessary activities.

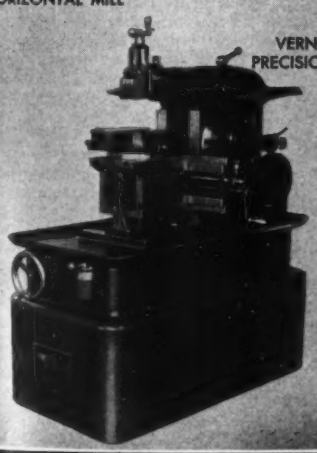
SIMPLICITY OF OPERATION enables students to get fundamentals without confusion of complicated controls.

ECONOMICAL POWER UNITS give maximum necessary power for jobs within capacity of machine—yet with comparatively small current consumption.

ACCESSORY EQUIPMENT especially designed for these tools gives students wide experience in handling out-of-the-ordinary jobs and increases utility of each machine.

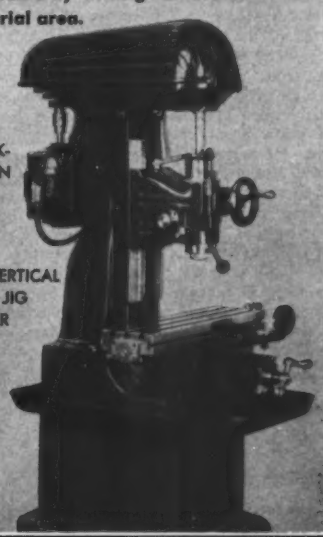
Complete specifications of the Vernon line are available by writing for folders. Dealers in every important industrial area.

VERNON NO. O HORIZONTAL MILL



VERNON 11" PRECISION SHAPER

VERNON 12" HEAVY-DUTY BACK-GEARED PRECISION SHAPER



VERNON VERTICAL MILL & JIG BORER

MACHINERY MANUFACTURING COMPANY

1915 EAST 51 ST., VERNON LOS ANGELES, CALIFORNIA

Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

SEBASTIAN GEARED HEAD LATHES

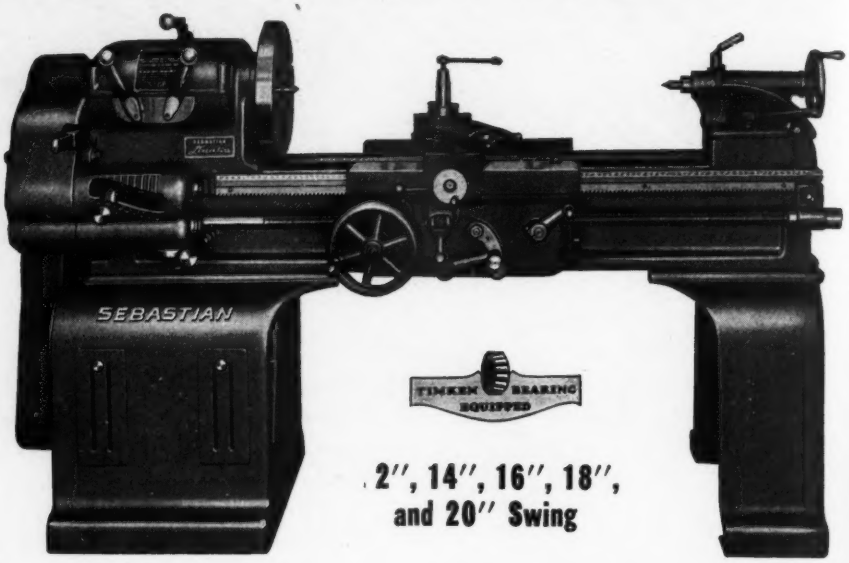
MEDIUM PRICED

•

TIMKEN BEARINGS

•

THE MOST OUTSTANDING VALUE IN ITS PRICE FIELD



12", 14", 16", 18", and 20" Swing

Notable among the many desirable features of Sebastian Lathes are the Eight Speed geared Headstock with Timken bearings on all shafts — assuring accuracy and from 15% to 20% more power; Oversized heat treated, hardened and shaved steel gears in Headstocks—assuring longer life and very powerful head; Accuracy .0005" at every point of alignment; Friction Clutch for start and stop of main drive, mounted conveniently on headstock.

Write now for prices and complete detail

THE SEBASTIAN LATHE COMPANY Box 1017 Cincinnati, Ohio

(Continued from page 50A)

Would you suggest having corresponding floral patterns in the backs and a plain seat, or should the seat have a corresponding design?

Would you think an allover conventional design to be better than the floral?

I have never been able to find a piece of canvas large enough to cover this piece. I suppose I will have to purchase it by the yard. — *F. M.*

A.: The rocker in your sketch is what has commonly been termed a Boston rocker. It is true to type except for the front legs, which are nearly always as shown in the sketch.

I know of no classification into which I could place the settee. The sketch is not very helpful. If the legs are proportioned as shown in relation to the rest of the piece, I would recommend making an allover slip cover for it and letting it go at that. It may be a homemade piece, or it may be the product of some furniture company who built it from their own design. As to the cover, it is quite possible that a tastefully designed and colored piece of cloth would make it a fairly acceptable piece of furniture. — *Franklin H. Gottshall.*

REFINISHING PAINTED MAPLE ROCKER

1082. Q.: I would like to refinish a maple rocker which has been painted. Kindly give directions for removing the paint and also the type of finish to use on the old maple rocker. — *F. M.*

A.: 1. Do all the repairing and regluing before attempting to remove the old finish.

2. Use a waxless varnish remover to strip all old finish off as far as possible, or

3. Use No. 2 steel wool and shellac grade denatured alcohol for the same purpose.

4. Sand off all remains of paint staining and the original red buttermilk priming coat, to white wood.

5. Use a commercial two-solution bleach to further whiten all remaining traces of color. Do not slight the work of sanding as the bleach will not take out pigmented stains. Let the bleach dry overnight and then wash off with clean denatured alcohol to dissolve all traces left.

6. Sand clean and smooth with not less than 4/0 paper.

7. Stain with a Honey Maple or Amber Maple water stain. Refer to detailed directions in *Wood Finishing and Painting Made Easy,* Bruce Publishing Company, Milwaukee, Wis.

8. Finish with lacquer if spray equipment is at hand, or eggshell varnish as desired.

9. A beautiful and very permanent finish may be had by using DuPont Penetrating Wood Finish as per directions on the label. This is particularly suited to the work of refinishing antiques of all types. — *Ralph Waring.*

News Notes

♦ Subjects of nation-wide interest are listed in the General Electric Company's colorfully illustrated 1942 motion-picture catalog. Defense, X-ray, railroads, lighting, home economics, five of the famous "Excursions in Science," and a life of Thomas A. Edison, the electrical wizard, are among the educational and commercial films offered. Both sound and silent types are available, and several of the sound films are in full color. All are listed in the 16mm. size, and most of them also in 35mm.

These motion pictures are free (except for shipping fees) to organized groups such as schools, churches, and social, civic, and business organizations in the United States. For information, write Visual Instruction Section, Publicity Department, General Electric Co., Schenectady, N. Y., or to the nearest G-E office.

♦ The Illinois State Training School for Boys at St. Charles will install a $15,000 machine shop. This installation will be part of a readjustment program which aims to furnish vocational training to the 675 boys who are in the institution.

♦ A new specification covering folding chairs for schools, designed to encourage correct posture and promote the comfort and safety of pupils, has been prepared at the National Bureau of Standards, Department of Commerce.

In an investigation 92 chairs submitted by 18 manufacturers were measured for compliance with the principles of safety, comfort, and posture, and tested for strength and durability. From the facts thus established, specifications were written in terms of use factors, leaving maximum freedom to the manufacturer in adopting methods for meeting these use requirements.

♦ Minnesota will organize classes in metal, wood, electricity, and repair of farm machinery for rural youth throughout the state as part of the defense training effort.

♦ California State Polytechnic School, San Luis Obispo, Calif., is starting a four-month short course in specific farming and industrial occupations. The objective of this program is to give employment skills, primarily to young men graduating from high school at midyear.

♦ An illumination table has just been prepared by the Westinghouse Editorial Service, East Pittsburgh, Pa., which may be both interesting and useful to teachers of industrial arts and vocational education who have the dual responsibility of teaching shop and coaching athletic teams. This illumination table lists the foot-candles required to illuminate areas devoted to night games and athletic activities of all kinds.

♦ The All-State Industrial Arts Conference is to be held this year at State Teachers College, California, Pa., for two consecutive days, April 24 and 25, 1942. Printing instructors will want to keep this date in mind. For further information relative to this big state event, write Anthony T. Stavaski, instructor of printing.

♦ Following the resignation of Hubert Howe as auto and machine-shop instructor, VERNON JOHNSON was employed to fill that vacancy at

(Continued on page 56A)

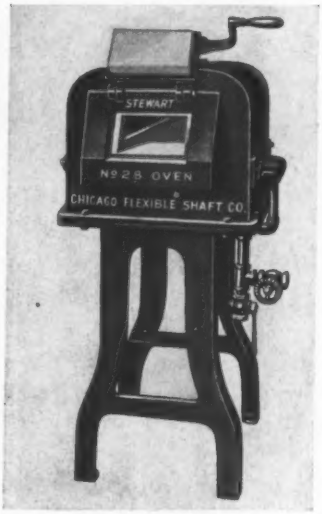
STEWART FURNACES FORGES COMBINATION UNITS STEWART

DESIGNED AND BUILT FOR VOCATIONAL EDUCATION WORK

FAMOUS STEWART No. 28 OVEN FURNACE

This handy, compact, general purpose Furnace is widely used by vocational instructors and for tool-room work. A reducing or neutral atmosphere is easily obtained by regulation of the valves. Inside walls of the U-shaped bottom slab are designed to prevent work being pushed off the slab and prevent any direct flame from touching work. Removable plate on rear of furnace to make replacing of slab simple and speedy. Pyrometer opening in rear wall. Lined with first quality refractories. Available for high speed steel work at extra charge with carbofrax hearth and support. Heavy duty STEWART cast iron and welded steel construction.

Door opening 4" x 8" and is 12" deep giving a hearth area 8" x 12".



STEWART No. 28 Oven.

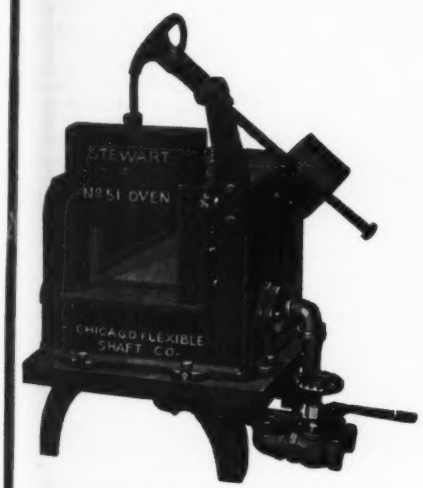
STEWART No. 28 BENCH OVEN

This Unit is similar to the No. 28 Oven described above except that it is equipped with short legs for bench use.

Either of these Ovens can be supplied with a counter-balanced door at a small extra charge. Thousands of STEWART 28's have been giving day in, day out service for twenty years or more throughout the country.

STEWART No. 51 BENCH OVEN

Designed for general utility work in school-room or tool-room the STEWART No. 51 Bench Oven is a handy, compact unit handling high speed or carbon steels equally well. Indirect heating does not permit flame to contact work. Carbofrax U-shaped hearth prevents work falling off slab. Highest quality cast iron and steel construction. Opening 3" x 5". Depth 6". Hearth area 5" x 6".



STEWART No. 51 Bench Oven.

OTHER STEWART OVENS

The complete STEWART Line of Oven Furnaces include all types from the No. 51 Bench Oven with a hearth area 5" x 6" to Car Type, Conveyor and Plate Heating Units with a hearth area 15 feet x 30 feet. STEWART is perfectly equipped to serve you promptly on any requirements along this line. Write for recommendations and prices. Our engineers are at your service without cost or obligation on your part.

STEWART No. SK248 Forge.

STEWART FORGES

No. 3 FORGE

This very popular Forge has an opening 3½" x 8" and a depth of 10". It is frequently used in STEWART Triple and Dual Combination Units.

Cast iron body, base and legs for greatest strength and maximum length of service.

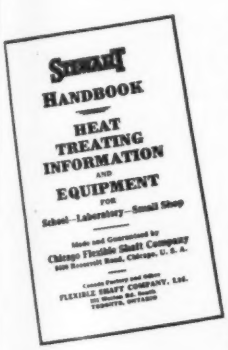
Burners on both sides create combustion immediately over the hearth giving a quick, positive, uniform heat throughout the chamber — quick.

SK248 FORGE

This sturdy STEWART Forge is designed for tool dressing rod end work, welding, center heats and similar purposes requiring a fast high heat. Air curtain in front protects operator. Quenching tank with rack for tongs. The opening is 2" high x 4" wide in front and heating depth 8" and the rear opening 3". A very popular Forge for school and shop work.

STEWART HIGH SPEED STEEL FURNACES

STEWART No. 28 Oven with carbofrax hearth and No. 51 Oven are ideal for high speed steel work where quantities are not large. For special high speed steel work we recommend the No. 3 High Speed Furnace (not shown) with cylindrical combustion chamber with opening 2" x 4" and depth 8". The No. 3 High Speed Steel Unit is frequently made a part of the STEWART Triple or Dual Combination Furnaces.

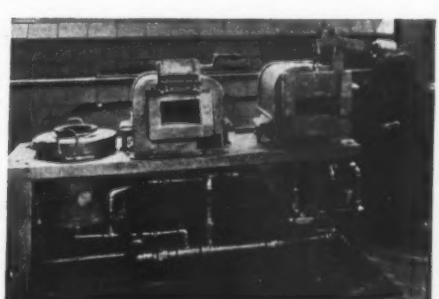


SEND FOR YOUR FREE COPY OF THE FAMOUS STEWART HANDBOOK

A new edition is now available for distribution to classes and will be sent without charge upon receipt of a post card addressed as below.

STEWART SAE STEEL SPECIFICATION WALL CHART

A new edition of the famous STEWART Wall Chart is available to Instructors. Also our monthly news bulletin "METAL MINUTES." A new Vest Pocket Heat Treating DATA BOOK has also been added to the Stewart Service Material for school shop teachers.



STEWART Triple-Purpose Combination Furnace to be used by both day and night classes of South Vocational High School, Pittsburgh, Pennsylvania.

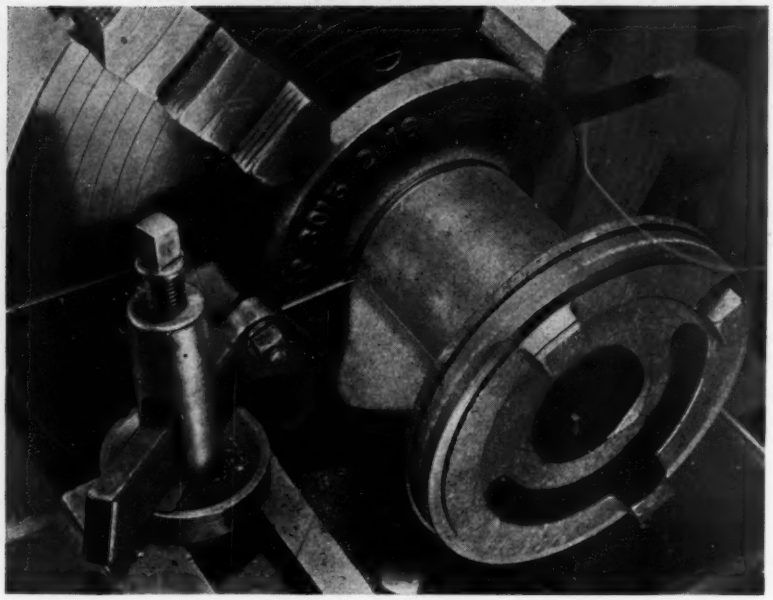
CHICAGO FLEXIBLE SHAFT COMPANY

Dept. 114, Stewart Industrial Furnace Division

5600 Roosevelt Rd., Chicago, Ill.

51 YEARS MAKING QUALITY FURNACES

ARMSTRONG



THE ARMSTRONG PRINCIPAL AGAIN MEETS A NATIONAL EMERGENCY

Overnight the National Defense Program created a new industry of such tremendous proportions it is measured in multiples of the vast automobile industry, and with it, created great shortages of machines, factory space, skilled labor, raw materials . . . of almost everything used in industry.

First and greatest of the shortages was in machine tools. Yet, although these new machine tools had to be built first with, and then equipped with ARMSTRONG TOOL HOLDERS; and although the building of numberless new dies, tools, jigs and fixtures required still other ARMSTRONG TOOL HOLDERS; and, thousands of existing lathes, planers, slotters and shapers had to be "re-tooled" for new defense products; *no critical defense work has been held up for want of ARMSTRONG TOOL HOLDERS.*

Again the basic Armstrong Principle of Tool Design — the principle of permanent drop forged shanks or tool holders which take cutter-bits any mechanic can quickly grind from stock shapes of high speed steel, has proven equal to this greatest test. With multi-purpose ARMSTRONG TOOL HOLDERS in over 96% of the machine shops, tool rooms and plants the "change over" to defense work, instead of causing universal delay and confusion, was in each case a matter of minutes—a matter of selecting the ARMSTRONG TOOL HOLDER and the correct cutter, adjusting for clearance, and starting work.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
322 No. Francisco Ave., Chicago, U. S. A.
Eastern Warehouse & Sales Office: 199 Lafayette St., N. Y.

Buy ARMSTRONG TOOLS from your Supply House

(Continued from page 52A)

Mount Clemens, Mich. He has reclassified the courses and prefers to use the term "metalworking," in which auto mechanics becomes just a division of the course. One semester is devoted to sheet metal; one to cold metal; another to the study of the automobile, Diesel engine, and airplane; and still another semester to practical work in automobile repair, body bumping and painting, automotive electricity, engine lathe, heat-treatment, and acetylene welding.

♦ The Stout Institute, Menomonie, Wis., is planning to make summer courses available starting with June 22, some of which are three weeks in length, others six weeks, and still others nine weeks.

Opportunities will also be given high school graduates to start their college work in the summer so that they may do four years of work in three years. This will, of course, necessitate their attendance at the nine-week summer session.

♦ Bradley Polytechnic Institute will intensify the work of all classes during the second semester this year, all classes attending six days per week, in order that commencement may be advanced to the middle of May.

Tentative plans have also been made to have a summer session which will cover three terms of 30 days each, so that students may complete a whole semester's work between the middle of May and the end of August.

♦ *Guidance Grows.* Ninety-six new books and pamphlets appeared in 1940, on methods and techniques alone. They are listed in *Guidance and Personnel Books of 1940,* a bibliography just published by Occupational Index, Inc., at New York University.

♦ Under a special plan, instituted to speed education in the interest of the national war effort, January high school graduates were allowed to enroll on February 2, in a midyear class at the University of Chicago and may receive the university's new bachelor's degree by June, 1943.

Exceptionally well-prepared members of the class, by taking advantage of the university's "advance-as-fast-as-qualified" system, may be able to complete the courses for their first year's work before June, which would mean accomplishing 30 weeks' work in 20 weeks. The remainder of the midyear class will take part in the more than doubled schedule of freshman courses in the summer quarter.

By completing their first-year work at this time, the students will be able to complete their general education in the college of the university to receive the bachelor's degree a year from June.

New Publications

Milling-Machine Indexing

By C. A. Felker and H. W. Paine. Cloth, 88 pp., 5 by 9 in., illustrated. Price, $1.50. Published by The Bruce Publishing Co., Milwaukee, Wis.

The authors of this book are providing the reader with an unusually comprehensive treatise on the important subject of indexing. Probably nowhere can anything quite as complete be obtained by those interested in machine-shop practice, toolmaking, or in the operation of the milling machine.

It is, therefore, of great value to the student who is taking up these subjects in high schools, part-time and full-time vocational schools, in apprentice classes, defense classes, and in adult-education classes.

Direct, differential, block, and compound indexing, as well as graduating with the indexing attachment are all fully covered.

Mathematics for the Aviation Trades

By James Naidich. Cloth, 267 pp., 6 by 9 in., illustrated. Price, $1.80. Published by McGraw-Hill Book Co., New York, N. Y.

The aviation mechanic will find just the material that he needs for carrying on his work. There is a complete review of fundamentals in arithmetic; areas, volumes, and weight; applications of the former to specific airplane computations; strength of materials; allowances for bends; power; fuel consumption; and compression ratio and valve timing.

The book also contains 100 selected review problems. While this book will be of great value to the student at school or in vocational classes, it will be of equal value to the mechanic, already in the trade, who wants to review the mathematics which his occupation requires him to possess.

50 Metal-Spinning Projects

By James E. Reagan and Earl E. Smith. Cloth, 110 pp., 6 by 9 in., illustrated. Price, $1.75. Published by The Bruce Publishing Co., Milwaukee, Wis.

These authors of a previous book entitled "Metal Spinning," present in this volume 50 well-chosen designs, which with those already presented in their first book, furnish an excellent group of projects for any metal-spinning class.

MISCELLANEOUS

Employee Organization for Fire Safety

Presented by National Fire Protection Association, 60 Batterymarch St., Boston, Mass. Paper, 46 pp., 6 by 9 in., illustrated. Price, 25 cents.

Consumer Education

An Annotated Bibliography by Edgar Dale and Norma Vernon. Paper, 35 pp., 6 by 9 in. Price, 25 cents. Published by Bureau of Educational Research, The Ohio State University, Columbus, Ohio; and Institute for Consumer Education, Stephens College, Columbia, Mo.

Industrial Arts and the American Tradition

By Boyd H. Bode. Paper, 11 pp., 6 by 9 in. Published by Epsilon Pi Tau, University Station, Box 3111, Columbus, Ohio.

This pamphlet contains the address which Boyd H. Bode presented at Muncie, Ind., on November 1, 1941. Twelve chapters of Epsilon Pi Tau had assembled to receive this message in which the significance and need of industrial arts in American education is strikingly presented.

(Continued on page 58A)

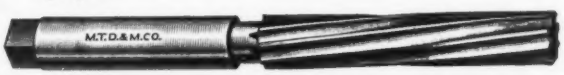
TEACH The VALUE of QUALITY

Molding shop students into true *craftsmen*—respecters of fine work, fine materials, fine *tools*—is the most important job any shop instructor can have. . . . You'll start your charges in the right direction by specifying Morse Cutting Tools. For wherever *quality* is honored, the name of Morse is known and honored . . . "There IS a Difference!"

MORSE TOOLS FOR THE SCHOOL SHOP

(*above*)
No. 302 Taper Shank Drill. Of selected carbon steel, for all power drilling not requiring high speed.

No. 330 Straight Shank Drill. So-called "Jobbers'" drill of carbon steel, for use in all types of hand drilling.



(*above*)
No. 602 Hand Reamer. Spiral Fluted, carbon steel reamer, ideal for general hand use in the shop.

No. 717 Expansion Reamer. Available in 9/16" to 2" diameters. Its expansion feature makes it highly useful in school shop work.

No. 1045 Spiral Pointed Hand Tap. For machine tapping of most common materials in through holes. Furnished in plug style only.

No. 1184 Adjustable Round Die. In all sizes and threads, for hand thread cutting of commonly used metals.

The Morse Catalog is a valuable 256-page reference book on quality cutting tools. A free copy will be sent to Instructors and Superintendents requesting it on their official School or Shop Letterhead.

MORSE TOOLS FOR THE ADVANCED OR AUTOMOTIVE SHOP

No. 1302 High Speed Taper Shank Drills. Tempered and designed for steady production work in power-drilling machines. Diameter from 1/8" to 3".

No. 1728 High Speed Adjustable Reamer. Six tapered blades slide lengthwise in slots, and are held in position for desired diameter.

No. 1683 High Speed Taper Pin Reamer. Helical Flutes. Taper 1/4" per foot. Indispensable in any work where taper pins are used.

No. 495 Combined Drills and Countersinks. Made of Carbon Steel, in all popular sizes and types, for drilling and countersinking center holes, or for starting holes at an angle.

No. 773 Screw Extractor. A very useful tool for removing broken-off pieces of studs, bolts or screws from holes.

No. 1805 Heavy Duty End Mill. Coarse-toothed, spiral heavy-duty mill. Available in right-hand or left-hand types.

No. 1809 Alternate Tooth Milling Cutter. Alternate teeth provide a shearing cut and ample chip clearance for deep slotting in tough metals.

No. 1040 Hand Tap. All popular sizes and pitches. Plug style illustrated.

No. 1145 Tap Wrench. Furnished in sizes 0 and 1, to handle all taps from 1/16" to 5/16", and reamers from 1/8" to 15/32".

For orderly, systematic arrangement of drills, Morse Drill Blocks and Drill Cases are ideal for the school shop.

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THE MORSE LINE INCLUDES HIGH SPEED AND CARBON DRILLS - REAMERS - CUTTERS - TAPS and DIES - SCREW PLATES - ARBORS - CHUCKS - COUNTERBORES - MANDRELS - TAPER PINS - SOCKETS - SLEEVES

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PRECISION LATHES
A complete line of full sized, full weight 10", 11" and 12" Precision Lathes . . . bench, floor and pedestal types built to industrial machine tool standards and specifications. Rigid, heavily braced, semi-steel beds with hand scraped ways — 2 "V"-ways and 2 Flat Ways. Large hardened steel spindles, ground all over and individually fitted into hand scraped bearings. Each lathe has a full complement of attachments and accessories. Each model gives more lathe per dollar.
For schools—Type "U" Sheldon Lathes (second from top) are especially recommended because they have a 4-speed Roller Bearing V-Belt Drive enclosed in cabinet leg. No belt Shifting. Speed changes are instantaneous through clutches operated by outside lever. Student never touches belt or moving parts. Full Quick Change Gear Box (4 to 224 threads per inch). Longitudinal Worm Feed with Power Cross Feed, Thread Chasing Dial.
Write for Catalog and Prices
SHELDON MACHINE CO., INC.
4244 No. Knox Ave.
Chicago, U. S. A.

(Continued from page 56A)

Principles and Techniques of Vocational Guidance

By George E. Myers. Cloth, 377 pp., 6 by 9 in. Price, $3. Published by McGraw-Hill Book Co., New York, N. Y.

A textbook emphasizing the need of vocational guidance as a specific type of guidance, and giving a clear and well-defined technique for giving vocational guidance to the student living under conditions as they exist today.

The book contains 18 chapters in which vocational guidance; the need for and the responsibility of the school in offering an organized program of vocational guidance; the services involved in offering such guidance; and the need for counseling, preparing, placement, and follow-up; are all clearly and very explicitly and comprehensively taken up.

The Art of Photo-Engraving

By Robert C. Kroll. Published by Industrial Arts Laboratory Press, San Jose State College, San Jose, Calif., 1941.

A condensed reprint of an article on the subject by the author, this beautifully printed little booklet gives a brief, yet quite complete picture of the photoengraving process.

Aerodynamics

By James A. Brill and H. A. Gray in collaboration with R. J. Stephenson and Lieut. W. T. Brownell. Paper, 36 pp., 5⅜ by 7⅞ in., illustrated. Price, 15 cents. Published by The University of Chicago Press, Chicago, Ill.

This booklet is a guide to be used with the instructional sound films, "Theory of Flight," and "Problems of Flight," prepared by Erpi Classroom Films, Inc., 35–11 35th Ave., Long Island City, N. Y.

Training Oxy-Acetylene Welding and Cutting Operators

Compiled and presented by the Oxy-Acetylene Committee, International Acetylene Association, 30 East 42nd St., New York City. Paper, 88 pp., 6 by 9 in. Per copy, 25 cents; de luxe edition, 75 cents.

A very concise and helpful booklet containing outlines of training courses applicable to the preparation of welding operators for various types of general and specific welding are presented.

Mathematics for Electricians and Radiomen

By Nelson M. Cooke. Cloth, 604 pp., 6 by 9 in. Price, $4. Published by the McGraw-Hill Book Co., New York, N. Y.

A very comprehensive book on algebra, formulas, and trigonometry all applied to very practical problems in electricity. The use of the slide rule also is explained and illustrated. Nine very helpful tables make up the appendix.

Pictorial West Tech Open-House Book 1940

Photographed and designed at West Technical High School, Cleveland, Ohio.

Personal News

DR. MYERS RETIRES

The Guidance Association of Detroit and vicinity gave a dinner honoring Dr. George E. Myers on Monday, December 8, 1941.

Dr. Myers has completed 25 years of service at the University of Michigan and retired in January, 1942. He helped to develop the program of guidance and placement in Detroit, and is a charter member of the Detroit Guidance Association.

Dr. Myers

The association presented a life membership in the National Vocational Guidance Association to Dr. Myers at the memorial dinner. Tributes were paid to him by Dr. Warren E. Bow, deputy superintendent of schools of Detroit; by Dr. Charles Spain, president emeritus of Wayne University; by Dr. Warren K. Layton, director of the department of guidance and placement of the Detroit public schools; by Miss Cleo Murtland, associate professor of vocational education, University of Michigan; and by Miss Virginia Allan of Dearborn High School. All of the speakers were colleagues or former students of Dr. Myers.

A memorial volume containing letters from numerous friends and colleagues also was presented to Dr. Myers at this dinner.

Dr. Myers was born at Massilon, Iowa, November 26, 1871. He received the A.B. degree from the Ottawa (Kans.) University in 1896, the A.M. degree from the University of Chicago in 1901, and the Ph.D. degree from Clark University in 1906. He also studied at Columbia, 1914–15.

His educational experiences cover a wide field. He taught at a boarding school at Muskegee, Okla., 1896–99; taught mathematics at the high school in Colorado Springs from 1901–03, and was principal there from 1903–04. He belonged to the faculty of the McKinley Manual Training High School, Washington, D. C., from 1906 to 1911.

From 1911 to 1913 he was president of the Kansas State Manual Training Normal School,

(Continued on page 60A)

IT'S SOUND JUDGMENT TO

Teach Arc Welding

with arc welders that enjoy such wide industrial acceptance as...

HOBART "Simplified" ARC WELDERS

Here's Why...

• With Hobart Arc Welders accepted as standard equipment by so many manufacturers the country over, it's easy for your arc welding graduates to adapt themselves to actual industrial conditions. Then, too, arc welding with Hobart is easier because every arc welding step has been "simplified" for better and faster production of high quality welds.

Exclusive Remote Control. This is the valuable Hobart feature that enables your students to adjust welding heat at the work when changing rods or position, eliminating the usual necessity of returning to the welder. Then there is the Multi-Range Dual Control that offers the welder a selection of 1,000 combinations of current and voltage to choose from, enabling him to secure the EXACT heat for every job.

You can give your students the benefit of the complete Hobart course including equipment, text, lessons as used in Hobart's own Trade School as well as leading NYA classes and technical high schools. Use coupon for complete details.

Prepares Students for Big Pay Jobs

Teach your students one of the world's best paying trades.

Send Coupon!

Ask for school quantity prices.

NEW up-to-the-minute BOOKS on Arc Welding Uses, Techniques, Materials, Etc.

Just off the Press "PRACTICAL ARC WELDING MANUAL and Training Course"

This entirely new 1942 welding manual belongs on the desk of every student, engineer, designer and welding operator interested in any branch of the metal working industries. The entire book is written in plain English and contains 516 pages supplemented by hundreds of illustrations, tables and charts for easy understanding. Postpaid, only..... **$2**

Valuable LESSONS BOOK

This same 192 page "Lessons in Practical Arc Welding" book is used in the well-known Hobart Trade School to teach students the essentials and finer points of arc welding methods and applications. It tells everything one needs to know in operating a modern arc welder and gives exercises in practical welding problems. Liberally illustrated with photographs and self-explanatory drawings and diagrams. Postpaid, only..... **75¢**

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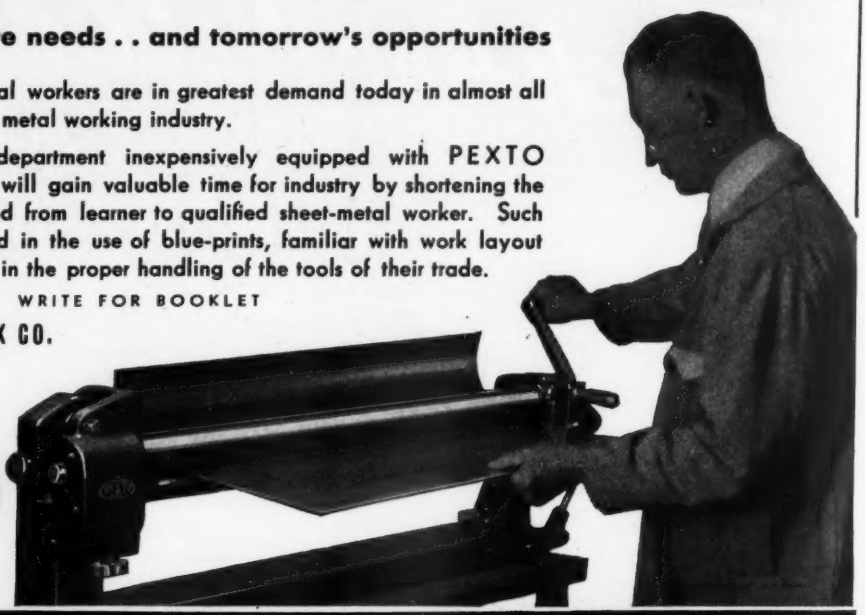

PEXTO SINCE 1885

SHEET-METAL WORKING Machines and Tools

(Continued from page 58A)

and then became supervisor of continuation classes at New York, where he remained from 1914 to 1917. He was appointed professor of vocational education and guidance at the University of Michigan, which position he held until his retirement.

He was lecturer on education at the George Washington University 1907–10, and taught at summer sessions at Indiana University, New York University, and the University of California. He also investigated industrial schools in England, France, and Germany.

Dr. Myers is also known for his professional writing, and is a member of the National Education Association, the American Vocational Association, the National Vocational Guidance Association, and Phi Delta Kappa.

His friends all join in wishing him many pleasant and enjoyable years, now that he has retired from the strictly regulated life of the busy university professor.

♦ H. H. GRUBER, director of vocational education at DuBois, Pa., has recently completed the requirements for the doctorate at the Pennsylvania State College. His research problem concerned the development of a formula for allocating state and federal vocational funds to local school units. The title of the dissertation is, "A State Plan for Subsidizing Vocational Education in Pennsylvania."

He was graduated from the State Normal School at Kutztown, Pa., in 1923, and later received the B.S. and M.S. degrees from Pennsylvania State College. His professional experience includes that of teacher of general education subjects, industrial arts, vocational trade, director of the evening school, and part-time extension teacher trainer for the state of Pennsylvania.

♦ E. E. HOWARD, director of industrial arts in State Teachers College, Millersville, Pa., since the industrial-arts department opened in 1930, resigned to take a position in the personnel department of the Armstrong Linoleum Co.

His work at present is concerned with the training of emergency workers in the firm's various industries.

Mr. Howard obtained both his B.S. and M.S. in education degrees from the Pennsylvania State College, State College, Pa.

♦ DR. BURL N. OSBURN, who has been on the staff of Pennsylvania State College, Sate College, Pa., since 1932, has been appointed director of the industrial-arts department of that institution to fill the place vacated by E. E. Howard.

Dr. Osburn has occupied the position of professor of education on the Ohio State University summer school staff since 1941.

He obtained his B.A. degree from Iowa State College, and his M.A. and Ph.D. degree from Ohio State University.

♦ C. B. COOLEY, formerly assistant professor of industrial arts, Branch Agricultural College, Cedar City, Utah, has been appointed to the state office of industrial and vocational education. He will be an assistant to State Director Howard Gunderson. Mr. Cooley will be charged with the responsibility of outlining courses of study and prepare tradesmen from industry to teach defense training courses.

♦ PAUL GREIN, a graduate of Western Michigan College of Education in 1931, is now teaching general shop at Eastern Junior High School, Bay City, Mich. Before coming to Bay City, Mr. Grein taught industrial arts and coached all sports at Oxford, Mich., for four years, and at Flushing, Mich., for six years. He starred on the varsity basketball team while at Western.

♦ FERMOR S. CHURCH, assistant headmaster of Los Alamos Ranch School, Los Alamos, N. Mex., will be acting headmaster during Col. Hitchcock's absence.

♦ BERNARD J. ROGERS, B.A., Yale, joined the staff of the Los Alamos Ranch School, Los Alamos, N. Mex., when school reopened after Christmas.

♦ N. E. WEISS, board of education, Melrose, Minn., has cross indexed articles appearing in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION under metalwork, woodwork, mechanical drawing, electricity, and general mechanics since January, 1940. He is anxious to exchange with teachers who have made similar indexes prior to 1940.

♦ PROF. RUSSELL J. SMITH, of Marquette University's College of Engineering, Milwaukee, Wis., was granted leave of absence to serve as executive engineer for the McDonell Aircraft Corp. at St. Louis.

♦ L. S. HITCHCOCK, headmaster of Los Alamos Ranch School, Los Alamos, N Mex., a lieutenant-colonel, Field Artillery Reserve, has been called to active service. He left Monday, January 12.

♦ REUBEN SCHAFER has been appointed to teach industrial arts in Flint, Mich. Mr. Schafer has been teaching in the Hawaiian Islands since 1934, but returned to Wisconsin last August.

Association News

A.V.A. CONVENTION

(*Continued from page 23A of the February, 1942, issue*)

At the Teacher Trainers and Supervisors-Research meeting of the Agricultural Education Section, held Wednesday, Dec. 10, at 1:30 p.m., H. M. Hamlin, professor of agricultural education, University of Illinois, Urbana, Ill., acted as chairman.

The report of the research committee was given by R. M. Stewart, professor of rural education, Cornell University, Ithaca, N. Y. G. P. Deyoe, Department of Agricultural Education, Michigan State College, East Lansing, Mich., discussed the economic factors and opportunities involved in the establishment of young men in farming. He emphasized the need of more careful guidance and placement as well as providing programs for supervised farm practice to effect greater student interest in farming and related occupations. J.

(Continued on page 74A)

THIS BOOK IS YOURS FOR THE ASKING

You can drill hardened steel—any analysis, *any hardness*—just like soft steel . . . with Hardsteel drills! No annealing, no special equipment; the free instruction book tells you how to drill, how to grind. Send for it NOW!

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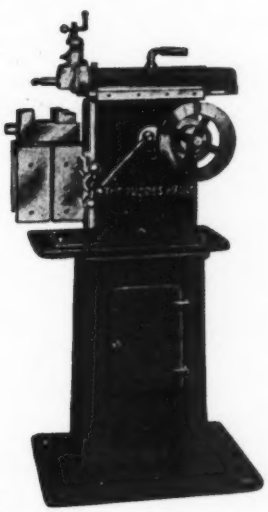
RHODES 7" SHAPER

RHODES SHAPERS SLOTTERS RMCo



A precision Shaper that is widely used for educational purposes. Easily converted into 3½" Slotter, making two machines in one. Available with countershaft drive, or with motor drive, using ½ H.P. motor, thus making a self-contained unit. Occupies small space. Priced low. Send for bulletin.

THE RHODES MFG. CO.
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TEACHING SCHOOL 24 HOURS A DAY

MARK says: Vocational educators have quickly responded to their part in the nation's wartime service by rapidly expanding the essential training of skills for industrial production, with particular emphasis on arc welding.

Many leading vocational schools are now on a 24 hour daily basis. To support this pace their shop equipment is called upon to withstand exhausting burdens. Machines for instructional purposes must *stand up.*

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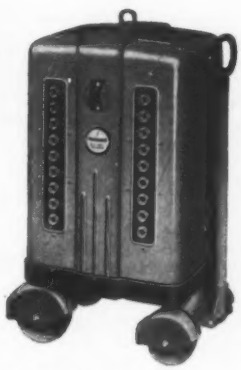
REG. U.S. PAT. OFF.
A.C. ARC WELDERS
"CAN TAKE IT"



The gruelling demands of production welding in actual industry have long proven the Marquette's remarkable capacity to continuously deliver superb performance at low operating and negligible maintenance costs.

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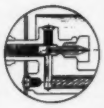
The Most Complete Manual on the Care and Operation of Blow Torches Yet Published

- **HOW A BLOW TORCH WORKS**

  Explains the difference between the Mechanic's Grade and the Sharp pointed Needle Burners. Identifies and describes the jet block, cleaner pin, flame control, veins, and other internal parts of both types of burner.



- **OPERATING THE BLOW TORCH**

  What fuel to use. How to fill, start, and stop. Increasing and decreasing flame volume for best economy and efficiency. The distribution of heat in the torch flame.

- **PROPER CARE OF THE BLOW TORCH**

  What to do to insure long life. Trouble shooting in the pump, thread joints, and flame. Detailed instruction on disassembling, cleaning, and reassembling the burner.

- **TYPICAL USES OF THE BLOW TORCH**

  Directions for soldering, sweating, brazing, burning off paint, and other operations involving use of the blow torch.

- **HELPFUL SAFETY SUGGESTIONS**

  Nine rules which if observed at all times, will make the blow torch a safe and useful tool for the most inexperienced student or workman.

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First Edition to vocational instructors *and their students* as long as they last, as Clayton & Lambert's contribution to the important job of training workers for wartime service. Clip the enclosed coupon and mail it today.

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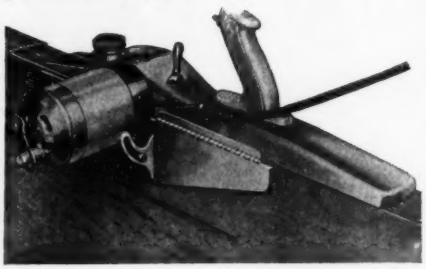
CARTER J4 POWER PLANE

The Carter J4 Plane is motor driven and will plane any edge — doors, sash, transoms, etc., up to 2 5/16 in. wide — either straight or bevel cut. It does the work three to five times faster than the planing could be done by hand. With its high speed universal motor (18,000 r.p.m.), and its patented spiral cutter, the J4 Power Plane does a smooth, uniform planing job regardless of the grain of the wood.



Set in a bench bracket furnished with the plane, the J4 may be used as a bench jointer for much of the planing of small work done in a school shop. With the bench bracket and a grinding attachment, the J4 can be easily set up to grind its own cutters.

Furnished as equipment with the J4 Plane are the cutter grinding attachment, grinding wheel and arbor, 2⅜-in. spiral plane cutter, bench bracket, wrench, and carrying case.

Made by the R. L. Carter Division, The Stanley Works, New Britain, Conn.

NEWLY DESIGNED CONTAINERS

Suregrip lines, and foolproof pouring, are outstanding features of the new bottles introduced by Higgins Ink Co., Inc., 271 Ninth St., Brooklyn, N. Y., for their half-pint, pint, and quart sizes of American India Ink.

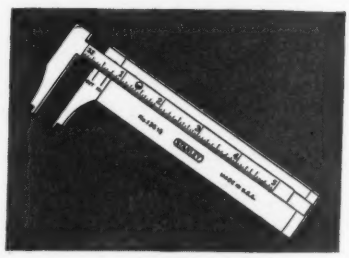
One important merchandising point in the new containers is that they have the same neck and shoulder effect as the familiar and popular ¾-oz. bottle. Years of universal use have associated this shape with the name "Higgins," and carrying the distinctive outline to the larger sizes provides quick product identity.

Labels on the new bottles are placed high, in a recess specially molded into the glass at the shoulder line. The labels are thus more easily visible when located on a shelf with other stock, and the recessed effect prevents them from rubbing against each other and being damaged.

NEW STANLEY POCKET CALIPER RULE NO. 136½

The new handy pocket-size caliper rule No. 136½ will be found very useful by mechanics, engineers, draftsmen, estimators, stockmen, building craftsmen, service and repairmen, school-shop instructors, and homecraftsmen. It is very handy for measuring rods, tubing, squares, cable, rope, bolts, pipe, and the like.

This rule may be used for obtaining both accurate inside and outside measurments. Caliper capacity permits measuring hole diameters from



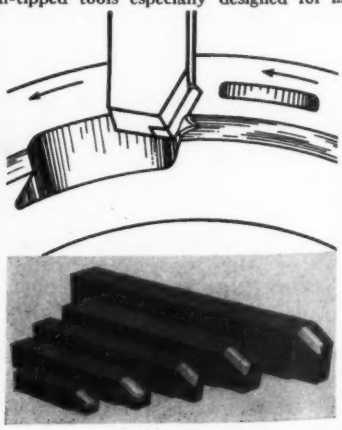
New pocket caliper

7/32- to 5-in. widths or lengths up to 5 in., and diameters of rounds up to 3 in.

It is made of boxwood, with brass caliper slide graduated by 16ths and 32nds its full length of 5 in. The head is carefully machined, and the back of the rule has vertical graduations in 16ths for easy measuring on straight surfaces. No. 136½ Rule is 5⅞ in. long, and 1 1/16 in. wide, and is made by Stanley Tools, New Britain, Conn.

NEW STYLE KENNAMETAL-TIPPED TOOLS

The McKenna Metals Co., 305 Lloyd Ave., Latrobe, Pa., announces new styles of Kennametal-tipped tools especially designed for interrupted cutting of steel castings and forgings in lathes, boring mills, shapers, and planers. These new Kennametal tools with the unique negative shear angle of 35 deg., combined with a positive



Kennametal-tipped tools

(Continued on page 72A)

Announcing

1.

A New *Revised* Edition of the Henry Ford Trade School's

SHOP THEORY

● Thoroughly revised and entirely reset — with many new illustrations and expanded material — this book now more than ever makes available to all shop classes the rich experience of the Henry Ford Trade School in preparing students for real payroll jobs.

Covers all fundamentals of shop work in the metal trades — development; construction principles; use, care, and operation of hand tools; precision tools; and the usual toolroom machines and equipment.

Net price to schools and defense training classes, $1.00 F.O.B. New York.

2.

MACHINE SHOP MATHEMATICS

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● This book covers the mathematical procedures needed for successful work in the machine shop trades. Suitable for all courses in introductory machine shop, especially for courses in the 11th or 12th grade. Problems cover all the usual operations of the shop and have been class-tested for six years. The language is that of a shop foreman giving orders for work to be done by the apprentice.

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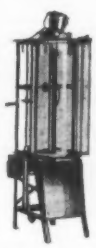
There are more Pease Blueprinting Machines in successful operation than all other makes combined. Moreover, 90 per cent of the leading commercial Blueprinters use Pease machines because Pease not only originated the process of printing, washing, developing and drying automatically by one continuous operation, but through more than thirty years of resourceful engineering, painstaking research and looking ahead, has maintained leadership in the Blueprinting industry.

MODEL "3" . . . a handsome table model continuous printer especially designed for making blueprints or direct process prints, where a comparatively small quantity is needed, or as an auxiliary unit with larger continuous blueprinting machines. Equipped with two low pressure Mercury Vapor tubes and using sliding contact, an exclusive Pease feature, this continuous Printer has an actual printing speed of from 2 inches to 2 feet per minute. It is made in the 42" size only.



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"JUNIOR" SHEET WASHER . . . recommended for use with the above models for washing blueprints and brownprints in cut sheet sizes, it dispenses with use of open bath tray, dripping prints and wet floors. The blueprints are washed better and dry more quickly than when soaked in a tray. Accommodates prints up to 24 x 36 inches. The Senior Washer can handle prints up to 54 x 72 inches.

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Printshop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- *a*) Hand, small size
- *b*) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- *a*) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *j*) Type, complete with 24 full-size California job cases, double work band, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.

CANS
- *a*) Benzine, pint size
- *b*) Benzine, 5-gal. size
- *c*) Kerosine, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

CASES
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼ size, for ornamental borders
- *c*) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- *d*) Metal furniture, to hold laborsaving fonts
- *e*) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- *a*) For platen presses
- *b*) For cylinder presses

CHASES
- *a*) For each size of platen press
- *b*) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- *a*) Lead and rule
- *b*) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- *c*) Paper, lever type, 26 in. or 30 in.
- *d*) Paper, lever type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

DESK — teacher's, with drawer compartments

DRYING RACKS
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- *a*) 12 by 18 in., with iron top, including reglets and furniture
- *b*) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 by 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- *a*) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- *b*) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- *a*) Overlay, for make ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

LEADER BOXES

LEADERS
- *a*) 6, 8, and 10 pt., fine dot
- *b*) 8 and 10 pt., hyphen

LINE GAUGES
- *a*) Metal, brass, or steel
- *b*) Wood

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- *a*) For use on presses
- *b*) Hand machines

ORNAMENTS
- *a*) Assorted floral and decorative designs
- *b*) Border, 6 and 12 pt., decorative

PERFORATOR
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

PLANER
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple, with leather top

PRESSES
- *a*) Cylinder, two revolution, four roller, 25 by 38, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 by 18, with cabinet
- *f*) Proof, 20 by 24, with cabinet

PUNCH
- *a*) Foot power, multiple with assorted punches
- *b*) Lever, two die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- *a*) 2 pt., laborsaving, hair line, side face
- *b*) 2 pt., laborsaving, 1 pt. side face
- *c*) 1 pt., laborsaving, 1 pt. face
- *d*) 2 pt., laborsaving, double face

SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SPACING MATERIAL
- *a*) Iron furniture, as selected
- *b*) Leads, laborsaving, 2 pt.
- *c*) Leads, 2-ft. strips, 2 pt.
- *d*) Slugs, laborsaving, 6 pt.
- *e*) Slugs, 2-ft. strips, 6 pt.
- *f*) Spaces and quads
- *g*) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

TYPE
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job, lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt.; 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *j*) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- *k*) Job, heavy copperplate Gothic — 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
- *l*) Wood, condensed Gothic — 8, 12, 15, and 18 line

TYPESETTING MACHINES
- *a*) Either linotype or intertype, 2 or 3 magazines, and molds
- *b*) Matrices for same, 6, 8, 10, and 12 point, as selected

Printshop Supplies

BENZINE OR GASOLINE — for cleaning type or presses

BINDERY TAPE — 2 in. wide, brown or black

GOLD BRONZE — pale

INK
- *a*) Bond, black, for bond papers
- *b*) Book, black, for school papers, etc.
- *c*) Cover, colors as selected
- *d*) Dryers and compounds, as selected
- *e*) Half tone, black
- *f*) Job, colors as selected
- *g*) Metallic, gold and silver
- *h*) Process, black, red, yellow, blue

KEROSINE — for cleaning rollers

PADDING CEMENT
- *a*) Cold
- *b*) Hot

PAPER
- *a*) Bond, fine grade, 17 by 22 — 20, white
- *b*) Bond, medium grade, 17 by 22 — 20, white
- *c*) Bond, sulphite, 17 by 22 — 20, white
- *d*) Bond, sulphite, 17 by 22 — 20, colors as selected
- *e*) Book, enamel, 25 by 38 — 80, white
- *f*) Book, machine finish, 25 by 38 — 80, white
- *g*) Book, eggshell finish, 25 by 38 — 60, white
- *h*) Cover, as selected, 20 by 26, medium
- *j*) Card Bristol, fine grade, 22 by 28 — 4 ply, white
- *k*) Index Bristol, medium grade, 25½ by 30½ — 110, white
- *l*) Index Bristol, medium grade, 25½ by 30½ — 140, white
- *m*) Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected
- *n*) Pressboard, red
- *o*) Strawboard, No. 40 or No. 50
- *p*) Tagboard, manila, 24 by 36 — 140
- *q*) Tympan, to fit presses
- *r*) Wrapping paper, size as selected
- *s*) Holder for same

PASTE
- *a*) Bindery
- *b*) Make ready

TWINE — cotton, for tying jobs

WIRE STITCHING
- *a*) No. 25 round wire for stitcher
- *b*) Wire staples, ¼ in.

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Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER
BEAM COMPASS
BENCH BRUSHES
BLACKBOARD
- *a*) Permanent or portable
- *b*) Compass, 15 in., with locking device
- *c*) Drawing set: T square, straightedge, triangle, and protractor

BLUEPRINT
- *a*) Frame or machine
- *b*) Washing trays or washer
- *c*) Paper tube, airtight
- *d*) Drying rack or dryer

BOOKCASE
CABINET
- *a*) For filing drawings
- *b*) For storing drawing boards
- *c*) For storing drawing instruments
- *d*) For storing models

CALIPERS — 6 in. and 8 in., inside and outside
CHAIR — teacher's
DESK — teacher's
DIVIDERS — proportional
DRAFTING MACHINE — and accessories
DRAFTSMAN'S STEEL PROTRACTOR
DRAWING BOARDS — large
DRAWING-BOARD SUPPORTS — to be set on or attached to woodworker's bench
DRAWING TABLES AND STOOLS
- *a*) For students
- *b*) For teachers

INK-BOTTLE HOLDER
IRREGULAR CURVES — Nos. 17, 21, and 24, wood, rubber, or transparent
LETTERING ANGLES
LETTERING PENS — assortment of 12
LEVEL OR TRANSIT — builders' for architectural students
LEVELING ROD — for use with the transit
MACHINISTS' COMBINATION SET — 12 in.
MARKING PINS — for use with measuring tape, for architectural students
MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
- *a*) For cutting and trimming drawings and blueprints
- *b*) For disassembling and reassembling machine parts and models

TAPELINE
- *a*) 100 ft., steel, for architectural students
- *b*) 50 ft., steel or metallic

TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
- *a*) 30–60 deg., 14 in. transparent
- *b*) 45 deg., 10 in. transparent

TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK

Drafting—Small Equipment

To be provided by, or for, each student
DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30–60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
- *a*) Paper, 36 in. wide
- *b*) Writing fluid

PAPER
- *a*) Cross section, 8½ by 11 in.
- *b*) Detail, 24 by 36 in.
- *c*) Drawing, 24 by 36 in.
- *d*) Isometric, 7 by 10 in.
- *e*) Tracing, 36 in.

POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
- *a*) Fixing salts
- *b*) Paper, 36 in.
- *c*) Writing fluid

(Continued on page 72A)

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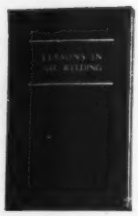

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THE LINCOLN ELECTRIC CO.
Educational Dept. Cleveland, Ohio

Drafting— Additional Supplies

(Continued from page 70A)

To be provided by, or for, each student

ERASERS
- *a*) Cleaning
- *b*) Ink
- *c*) Pencil

INK
- *a*) Black, waterproof
- *b*) Colored, if required

PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H

PENCIL POINTER PAD

THUMBTACKS OR SCOTCH TAPE

SHOP EQUIPMENT NEWS

(Continued from page 62A)

side rake of 15 deg., will permit the same economy in machining irregular sections as has been realized hitherto in simpler jobs.

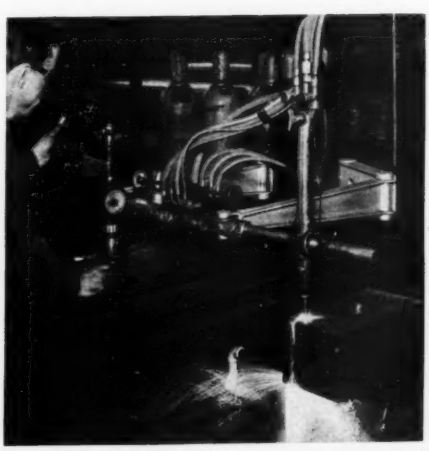
The principle of these new tools, known as Kennametal styles 35, 36, 37, and 38, is that the interruption on the work first strikes the tool at a place back of the extreme point, where the cutting edge is mechanically strong, and then shears off the chip with a progressive action. These tools are made either right or left hand. The tips are longer than on other standard Kennametal tools to compensate for the foreshortening of the 35-deg. shear angle and they project above the shank at the back to allow sufficient steel under the point.

OXYACETYLENE TIP WITH DIVERGENT NOZZLE

A series of oxyacetylene machine cutting tips which will speed up the rate of cutting from 20 to 30 per cent have been developed by Air Reduction, 60 E. 42nd St., New York City.

The Airco "45" high-speed machine cutting tip has a nozzle with a divergent orifice which ejects a narrow, high velocity stream of oxygen, practically free of exit turbulence. This produces a narrower kerf, and conserves on the oxygen consumption.

Airco "45" high-speed machine cutting tips are available in sizes 0, 1, 2, 3, 4, 6, 8, and 10 for cutting metal thicknesses up to 8 in. The tips fit all standard machine cutting torches.

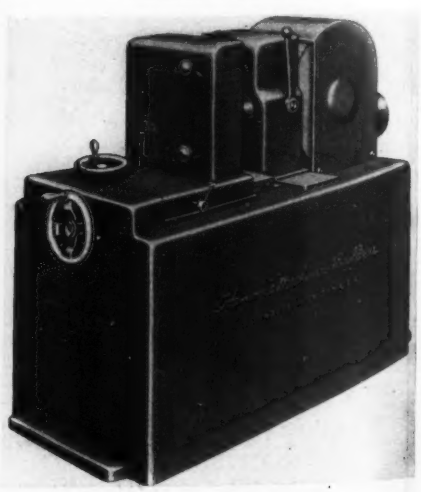


The Airco "45" high-speed machine cutting tip makes short work of cutting out a semi-circular piece from this 6-in. thick alloy-steel block used in a field gun

HAMMOND "OD" CYLINDRICAL POLISHER

Hammond Machinery Builders, Inc., 1665 Douglas Ave., Kalamazoo, Mich., announce the development of a new "OD" Cylindrical Polishing Machine capable of handling ¼ to 9 in. outside diameter cylindrical shapes, rods, and tubes. The range of feed of this machine is from 0 to 50 f.p.m., forward or reverse. The machine is simple to operate so that even an inexperienced operator can secure quality finishes at high-production rates.

(Continued on page 77A)



Cylindrical polisher

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Soldering skill—the knack of using *Kester Flux-Filled Solder*—is more in demand today, in certain industries, than ever before! Your boys can easily acquire it. They can learn, *in your shop,* how this standard material protects vital nerve centers, like radio and control equipment, in planes, tanks, ships, and general war communications.

And they'll get a bigger kick out of making things of metal, while they're using Kester Flux-Filled Solder—the kind that's easy to use and gets neat, permanent results.

The work they turn out, and the practical knowledge they acquire, reflects credit on you, their instructor. At the same time, you have simplified your job—because the self-contained flux in Kester eliminates flux-spattered floors and benches. You can cut convenient lengths of solder from the spool, one for each boy, if you desire.

Order Kester Flux-Filled Solder from your wholesaler, or write the address below.

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KESTER
FLUX-FILLED SOLDER

Free to SCHOOLS and INSTRUCTORS

an authoritative COURSE in SURFACE RACEWAY WIRING

In response to many requests, The Wiremold Company has prepared a practical and complete instruction course for electrical wiring with Surface Metal Raceways and Fittings.

Designed specifically for use in electrical shop courses, this material is conveniently divided into two parts: (1) Instructor's Key Sheets which give the correct fitting numbers for all required materials, and (2) Student's Assignment Sheets which include descriptions and diagrams of the assigned jobs. The Assignment Sheets are printed on special thin paper so that they may be handed out to students for blueprint reproduction if desired.

FOLLOWS APPROVED SCHOOL PRACTICES

In preparing this material, The Wiremold Company worked in collaboration with Mr. John J. L. Gross, Instructor in Applied Electricity at the Murrell-Dobbins School in Philadelphia. The course is in full accordance with approved school practices in teaching this subject.

WRITE FOR A FREE COPY OF THE COURSE

Free copies of the course are available, to schools and electrical instructors. Since the material represents a considerable investment in both time and money, we wish to limit the distribution to those vitally interested in it; therefore, we request that your letter be written on your school letterhead, or that it be accompanied by other suitable identification. A nominal price of $2.50 per copy has been set for general distribution.

This material is offered by The Wiremold Company as a free service to vocational and trade schools. We are sure you will find that it is interesting and authoritative, and that it will lend itself to practical application in electrical shop courses.

THE WIREMOLD COMPANY
HARTFORD, CONN.

(Continued from page 60A)

T. Wheeler, Department of Agricultural Education, University of Georgia, Athens, Ga., gave a composite review of community and parental factors relating to the establishment of young men in farming.

At the Thursday morning meeting of this section John G. Glavin, state supervisor of agricultural College, Logan, Utah, and L. E. Hawman. W. T. Spanton, chief, Agricultural Education Service, U. S. Office of Education, Washington, D. C., A. K. Getman, chief, agricultural education, Albany, N. Y., L. R. Humpherys, professor of agricultural education, Utah State Agricultural College, Logan, Utah, and L. E. Hawkins, agricultural commissioner, Chamber of Commerce, Kansas City, Mo., were the speakers.

The subjects discussed were: "The Agricultural Education Situation," "The Long-Time Viewpoint," "Organizing Agricultural Education for Maximum Effectiveness," and "Vocational Agriculture-Future Farmer Activities in Kansas City."

Agricultural Education

The Agricultural Education Standards Committee held a breakfast meeting on Friday morning. At the morning session C. B. Gentry, dean of faculty and professor of education, University of Connecticut, Storrs, Conn., presided.

The subjects discussed were "Agricultural Changes in Europe and Possible Effects on American Agriculture," and "Agricultural Planning for Defense," and the speakers were J. Clyde Marquis, Foreign Agricultural Relations Service, U.S.D.A., Washington, D. C., and Thomas L. Ayers, Southern Division, A.A.A., U.S.D.A., Washington, D. C. R. H. Woods, state director of vocational education, Frankfort, Ky., was the discussion leader.

H. O. Sampson, state supervisor of agricultural education, State Agricultural College, New Brunswick, N. J., was chairman at the Friday afternoon session at which the speakers, R. W. Gregory, specialist in part-time and evening schools, Agricultural Education Service, U. S. Office of Education, Washington, D. C., and D. M. Clements, agent, Southern Region, Agricultural Education Service, U. S. Office of Education, Washington, D. C., discussed the questions of "The Agricultural Situation and Out-of-School Farm Youth," and "Vocational Agriculture's Responsibility in Defense."

A panel discussion was also held on "Vocational Agriculture and Defense," and L. H. Dennis, executive secretary, American Vocational Association, Inc., Washington, D. C., was the chairman, and A. P. Fatherree, state supervisor of agricultural education, Jackson, Miss., M. D. Mobley, state director of vocational education, Atlanta, Ga., F. E. Moore, state director of vocational education, Des Moines, Iowa, H. O. Sampson, state supervisor of agricultural education, State Agricultural College, New Brunswick, N. J., Louis M. Sasman, state supervisor of agricultural education, Madison, Wis., and R. H. Woods, state director of vocational education, Frankfort, Ky., composed the panel.

At the Saturday morning session R. W. Heim, professor of agricultural education, University of Delaware, Newark, Del., presided.

At this session a report of the "Report of Agricultural Education Policy Committee" was made by J. A. McPhee, chief, Bureau of Agricultural Education, San Luis Obispo, Calif.

Fred A. Smith, vice-president of the A.V.A. for Agricultural Education, and State Director of Vocational Education, Little Rock, Ark., acted as chairman at the business meeting which followed.

Vocational Agriculture Teachers

Under the chairmanship of R. Arthur Lundgren, president, Massachusetts Agricultural Teachers Association, the Vocational Agriculture teachers held a meeting on Friday afternoon.

W. G. Weiler, assistant state supervisor of agricultural education, Columbus, Ohio, discussed "Have We Selected the Right Boys for the State Farmer Degree," and Ernest H. Nohle,

(Continued on page 86A)

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods
ANVIL
- *a*) No. 100 or No. 125
- *b*) Rim

ARMATURE GROWLER AND TESTER
AXLE STANDS
BATTERY EQUIPMENT
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

BENCH
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

BLACKBOARD
BLOWTORCHES — 1-qt. size
BOOKCASE
BRAKE
- *a*) Adjusting stand
- *b*) Band-lining machine

BULLETIN BOARD
CABINETS
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track
CHAIRS
- *a*) Teacher's
- *b*) For tables, or with tablet arms

CRANE — portable
CRANKSHAFT TRUING TOOL
CREEPERS
DESK — teacher's
DRILL
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ½ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

DYNAMOMETER — electric
FORGE — with blower and tools
FURNACES — gas
GREASE DISPENSERS
GRINDER
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

HONES — cylinder
JACKS
- *a*) Lever, 1½-ton
- *b*) Floor, roller

LATHE
- *a*) 11 in. by 4 ft., with motor, chucks, and attachments
- *b*) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- *a*) Arbor
- *b*) 30 ton

SPRAY PAINTING OUTFIT
VALVE REFACING MACHINE
VULCANIZER
- *a*) Electric steam for tube work
- *b*) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch
WHEEL ALIGNMENT
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

ABRASIVE — rubstone for cleaning castings in foundry
ALCOHOL TESTER
BATTERY
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *j*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

BITS
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.
CALIPERS — 6 in. inside and outside
CANS
- *a*) Oil, 1/3 pt.
- *b*) 1 gal., gas, safety
- *c*) 5 gal., gas, safety
- *d*) 5 gal., kerosine
- *e*) Waste

CHECKS — tool, 1000, blank
CHISELS
- *a*) Cape, ⅜ in. and ⅝ in.
- *b*) Cold, ⅜ in., ⅝ in., ¾ in., 1 in.
- *c*) Diamond point

COMBINATION SQUARES — 12 in.
COTTER-PIN EXTRACTOR
DIVIDERS — 6 in. and 10 in.
DRILL SETS
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

FILE CARDS
FILE HANDLES — assorted
FILES
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid
FIRST-AID CABINET AND SUPPLIES
FLOOR BRUSHES — 18 in.
FUNNELS — tin, assorted sizes
GAUGES
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

GLASS CUTTERS
GOGGLES
GREASE GUNS — plain and pressure type
HAMMERS
- *a*) Ball peen, 4 oz.
- *b*) Ball peen, 1¼ lb.
- *c*) Ball peen, 2 lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

LADLE
- *a*) 3-in. bowl
- *b*) 6-in. bowl

LAMPS — extension, with reels
LEAD POT — gas
MAGNET CHARGER
METERS — volt and ammeter test
MICROMETERS
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

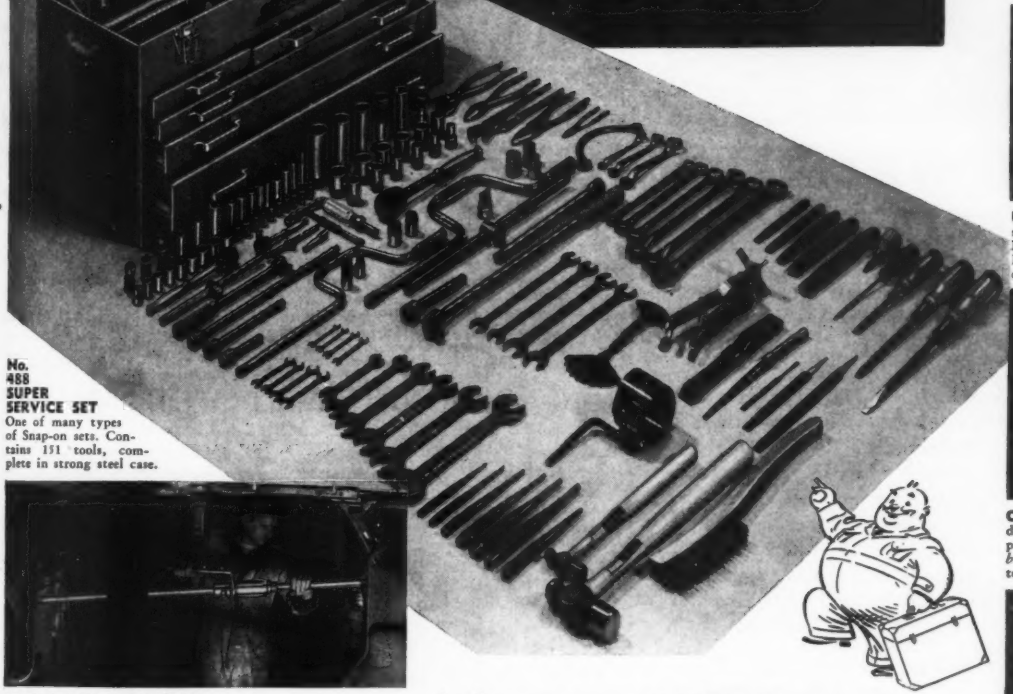
MOLDS
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

OILSTONE
PIPE TAPS — ⅛ in., ¼ in., ⅜ in., and ½ in.
PLIERS
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Roundnose

(Continued on page 76A)

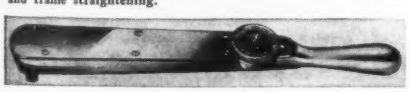
Train students quickly with accurate, professional

Snap-on Tools



No. 488 SUPER SERVICE SET One of many types of Snap-on sets. Contains 151 tools, complete in strong steel case.

HYDRA-PAK BODY JACK—No hose—no motors—no remote power connections. Power unit is right on tool itself where you can regulate pressure as you watch the work. 10-ton capacity. No over-riding. Handles all kinds of body and frame straightening.



TORQOMETER—Measures tension with absolute accuracy, no matter *how* you hold or pull. Simple to use—set dial at tension desired and tighten until dial reads zero. 150 ft. lbs. capacity. Ratchet adaptor, optional.

SPEED HONE—Enlarges, trues and finishes holes in all types of bushings—*in all kinds of metal*. Hones both piston bosses at once. Operates on any ½" drill—speed sleeve for fast hand feed—no overcutting. .00025" accuracy. Capacity 11/16 to 1½".

More than 3,000 Snap-on Tools from which to choose!

You can get more of the present-day "feel" of real shop conditions into your classes by using Snap-on tools and demonstrating their applications . . . wherever such procedure can fit into your plans. For these tools are depended on for maintenance by every leading American airline . . . for production in America's foremost aircraft plants . . . for important operations in vital defense factories. In the automotive industry, greatest of them all and now changing to "all-out" defense, "Snap-on" has been a name for tool leadership for 22 years.

Catalog showing complete line of more than 3,000 tools, and information on any tool subject, is yours for the asking. Write . . .

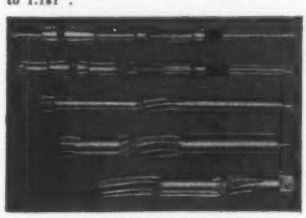
SNAP-ON TOOLS CORPORATION

8052-B 28th Avenue - - - Kenosha, Wisconsin

UNIVERSAL STEERING WHEEL PULLER—Pulls any steering wheel on any vehicle without marring parts. Fast straight-line power application. Adapters available for unusual types of wheels.

UNIVERSAL PULLER—Pulls large and small gears, sleeves, hubs, pulleys, flanges, Pitman arms, grease retainers, bearings, etc. Max. large jaw cap. 6¼". Min. small jaw cap. ½".

CLUTCH ALIGNER—Aligns any single disc clutch. Simple to use . . . locks in position in pilot bearing, permitting use of *both* hands for work. Pilot capacity .590" to 1.181".



PRECISION REAMERS—Complete line of all types—expansion reamers both long and short blades; solid reamers; aligning reamers in both expansion and solid types.

ELECTRIC DRILL—Only fist-wide (3½") but full ½" drill capacity. Fully balanced with 100% anti-friction bearings, helical gears. 18 other Snap-on drills from 3/16" to ⅞".

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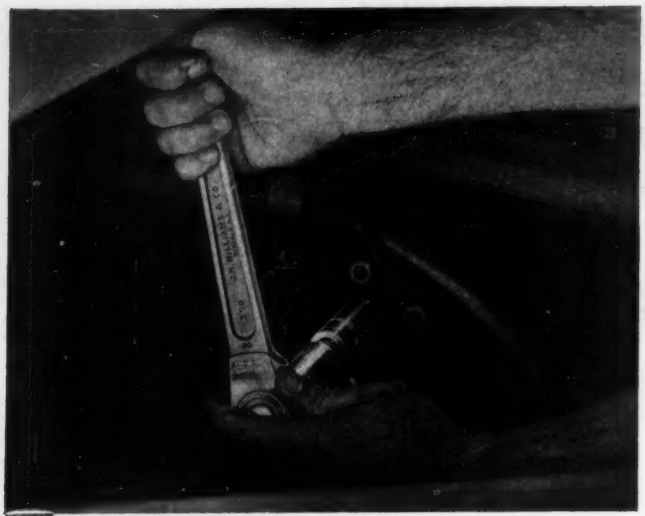
Brooklyn, N. Y., 1649 Bedford Ave.
Buffalo, N. Y., 628 W. Utica St.
Chicago, Ill., 2023 Michigan Ave.
Cincinnati, Ohio, 648 E. McMillan St.
Cleveland, Ohio, 2912 Euclid Ave.
Dallas, Texas, 2809-11 Main St.
Denver, Colo., 232 Broadway
Detroit, Mich., 93 Piquette Ave.
Houston, Texas, 109 Polk Ave.
Indianapolis, Ind., 848 Ft. Wayne Ave.
Jacksonville, Fla., 119 W. Ashley St.
Kansas City, Mo., 2516 Grand Ave.
Los Angeles, Calif., 1845 S. Flower St.
Milwaukee, Wis., 2417 W. State St.
Minneapolis, Minn., 1218 Harmon Pl.
Montreal, Quebec, Can., 751 Jean Talon St. West (Park Extension)
Newark, N. J., 441 Central Ave.
New Orleans, La., 938 Poydras St.
New York, N. Y., 1462 Inwood Ave., Bronx
Omaha, Nebr., 109 S. 24th St.
Philadelphia, Pa., 1705 Fairmount Ave.
Pittsburgh, Pa., 7007 Kelly St.
Richmond, Va., 1645 West Broad St.
San Francisco, Calif., 276 Golden Gate Ave.
Seattle, Wash., 1101 Oline Way
St. Louis, Mo., 2647 Washington Blvd.
Syracuse, N. Y., 751 S. Warren St.
Toledo, Ohio, 1428 Adams St.
Toronto, Ont., 130 Laird Dr. (Station K, Leaside)
Vancouver, B. C., 1211 Granville St.
Winnipeg, Manit., 80 Lombard St.



SPECIAL WRENCHES FOR SPECIAL WORK

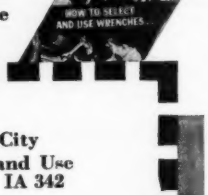
Extra deep sockets for spark plug servicing are just one of the hundreds of specially-designed wrenches made by Williams. In more than half a century of fine tool making, Williams' engineers have developed many original wrench patterns which offer more in utility, convenience, safety and precision. There is probably a special Williams' type that will make your job easier and your workmanship better.

WILLIAMS YOUR BEST BET FOR WRENCHES

Williams' line includes both Carbon and Alloy steel types for practically every kind of service. Mill supply and Automotive jobbers everywhere sell them. Trade and Vocational Schools can buy them from these suppliers at a liberal discount.

GET YOUR FREE COPY

An interesting, informative book that every mechanic needs. Data on wrench types, tables of sizes, helpful action photos. The coupon brings your free copy.



MAIL THIS COUPON

J. H. Williams & Co.,
225 Lafayette St., New York City
Please send "How to Select and Use Wrenches." IA 342

Name_____

Address_____

City_____ State_____

PULLERS
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

PUNCHES
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

PUTTY KNIVES
REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ½ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS — 1, 2, and 3 lb. with handles
SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *j*) Valve-tappet wrenches

Automotive Shop— Materials and Supplies

ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
BOLTS
- *a*) Machine, selected sizes
- *b*) N.F., selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
EMERY CLOTH — Nos. 2/0, 0, ½, and 1
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSINE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated, square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long.
SANDPAPER — Nos. 2/0, 0, ½, and 1
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron, or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

(Continued from page 72A)

This sturdy machine has a heavy wheel-head mounting, with the large spindle running in sealed precision ball bearings. A slide provides quick adjustment of the polishing and patented cushion wheels.

The Vari-Matic feed is motor driven through a variable speed drive, allowing various speeds of rotation of work as well as feed. A quick release lever enables the operator to control the work being fed through the machine.

The work support is adjusted by quick simple means for work of varying diameters.

All parts are carefully guarded and readily accessible.

MACHINE-TOOL CABINETS

The machinist is offered a handy workbench-cabinet which features security and all-round usefulness. Heavy-gauge working surface is ideal for small vises and grinders.

Twelve square feet of enclosed storage area are protected by full swinging triple latch doors equipped with padlock hasp or built-in flat key lock. Center shelf is adjustable on 1½-in. centers. Finished in durable Lyon green baked enamel.

Write Lyon Metal Products, Incorporated, 3—Clark St., Aurora, Ill., for additional information.

TRANSPARENT PLASTICS

Transparent Plastics have a real place in the creative field. This material comes at an opportune time when priorities seem to be playing havoc with other supplies.

Universal Transparent Plastic looks like glass. It is worked like any hardwood. When placed in an oven and gradually heated to between 325 and 400 deg., it may be formed as desired. For instance, a round disk, after being softened with heat, may be placed between two saucers, pressed together, and immersed in water. The resulting form looks like a pyrex dish. A strip 1½ by 6 in. softened with heat may readily be bent around an oval form of wood to make a bracelet. This may then be decorated with an electric pencil. Letter openers also are popular with beginners.

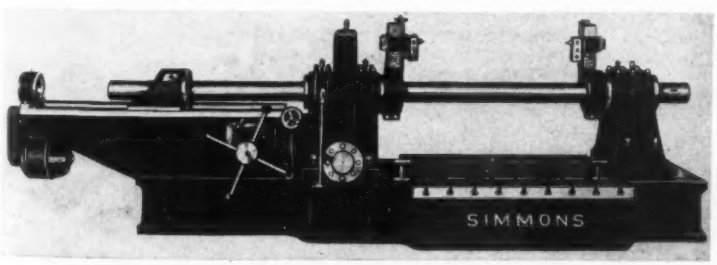
Subscribers to INDUSTRIAL ARTS AND VOCATIONAL EDUCATION may get a small free sample by writing, on school stationery, to the Universal Handicrafts Service, Inc., 1267 Sixth Ave., New York City.

ADD NEW MACHINE-TOOL DIVISION

The Simmons Machine Tool Corp. of Albany, N. Y., known for the past 30 years as one of the world's largest rebuilders of metalworking machinery, will build a new 6-in. bar horizontal boring and facing machine. In addition, the company builds at present a 48-in. and 54-in. heavy-duty engine lathe, a No. 2 turret lathe, a No. A-1 plain milling machine, and a line of standard and gap bed lathes of similar sizes.

Charles A. Simmons, Jr., executive vice-president and general manager, last week announced the formation of a new machine-tool division. Mr. Simmons will direct the operations of this division, with B. A. Getz as his assistant in charge of sales.

Mr. Simmons also announced that L. W. Rolfe, manager of the New York office, has been transferred to Albany where he will assist in the operation of the rebuilding division. William C. Werley has been transferred from the Philadelphia territory to manage the New York office.



Simmons 6-in. Bar Horizontal Boring Machine with standard 17-ft. bar with widened center section

BOOKLET ON GAS APPLIANCES

Reliable Gas Products Co., Dept. B., 1020-22 2nd Ave, S.W., Cedar Rapids, Iowa, have just issued a new booklet describing the reliable line of gas appliances for use in school and industrial shops.

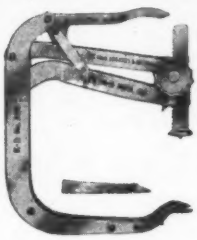
The items described are Bunsen burners; urn burners; single, double, and triple ring burners; valves and fittings; mixers and valves; straight, angle, and automatic hand torches; bench furnaces, melting furnaces, and melting pots.

This booklet will be mailed on request, when addressing the firm and mentioning Dept. B.

(Continued on next page)

THE RIGHT K-D TOOL
Does the job Easier, Faster!

HERE'S THE VALVE SPRING COMPRESSOR FOR GENERAL SHOP USE



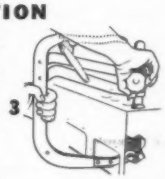
The K-D No. 380 is the ideal Compressor for general shop use because it services nearly all motors on the road today, both L-head and Valve-in-head. It has a throat opening of 10" x 10¼", jaws are adjustable for spring diameters and plunger bar is adjustable for spring depths.

EASY, FAST, ONE-MAN OPERATION

1

2

1. Adjust jaws to valve spring diameter by turning wing nut. **2.** Hold Compressor as shown, release ratchet lock and turn hand wheel until plunger bar is as high as it will go. **3.** Place Compressor in position on motor with operating handle down and raise first spring by turning hand wheel. When spring is raised ratchet lock will engage and depth adjustment will automatically be set. After keepers are out and you are ready to proceed, raise the opening handle to remove the Compressor. **4.** For all the rest of the springs after the first one, place the Compressor in position with the operating handle *up*. Pushing the handle down raises the spring.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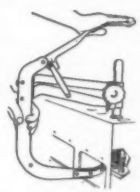

4

FOR ALIGNING IGNITION POINTS

115

The K-D 115 aligns ignition points right in the distributor—all kinds, all types. Designed by ignition experts, thousands are giving satisfaction. Carefully milled and tempered for long service.

These are only two of more than 60 K-D Tools "The Hustlers for your Tool Box" Write for your copy of K-D's latest catalog just off the press.

K-D TOOLS
Sold by Automotive Jobbers everywhere
FACTORY, LANCASTER, PA.

(Continued from previous page)

NEW TURRET LATHE BULLETIN

The new South Bend No. 2-H Turret Lathe is described in Bulletin No. 67-T, recently announced by the manufacturer.

This 4-page, letter-size bulletin is a condensed catalog which may be conveniently filed for ready reference. In it the South Bend No. 2-H Turret Lathe is fully illustrated and described. Complete specifications are given and construction features are shown.

This new lathe is adaptable to either long run or small lot production on a wide range of bar, chucking, or fixture jobs. It has a capacity of 1–3/8 in. through the spindle hole, 16-in. swing over the bed and saddle wings, and 1 in. through the collet.

Bulletin 67-T will be mailed on request from South Bend Lathe Works, Dept. 1A, South Bend, Ind.

DESCRIPTIVE BOOKLET ON PLASTIC RESIN GLUE

A booklet entitled "Weldwood Plastic Resin Waterproof Glue" has just been issued by the United States Plywood Corp., 616 West 46th St., New York City.

In it is described this one-part plastic resin adhesive which has the advantage that when mixed cold it is at once ready for use. Besides being waterproof, it is resistant to deterioration and stain free.

The booklet also contains a brief but interesting history of plastics. It also cites many examples of the practical uses to which this glue may be put.

NEW SKILSAW CATALOG

Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill., has just issued their catalog No. 43 in which are described the numerous portable tools which

(Continued on page 82A)

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH GRINDER
BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- *a*) Auger, 1/4 in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, 1/8 in. to 1/2 in. by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw driver, 1/4 in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- *a*) Spreader
- *b*) Taper
- *c*) Winder

DESK — teacher's, with drawer compartments
DRILL
- *a*) Breast
- *b*) Concrete, 3/8 in., 1/2 in., 3/4 in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to 3/8 in. by 32nds

DRILL PRESS
- *a*) Bench, hand, or power driven
- *b*) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- *a*) Blades, 10 in., 24 tooth
- *b*) Frames, adjustable

HAMMERS
- *a*) Claw, 12 oz.
- *b*) Machinist's, ball peen

HICKEY — 1/2 in. and 3/4 in.
LATHE
- *a*) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- *b*) Speed

PLIERS
- *a*) Gas, 6 1/2 in. and 8 in.
- *b*) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- *a*) Pipe burring, 1/4 in. to 1 in.
- *b*) Pipe burring, 1/2 in. to 2 in.

RULES
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

STOCKS AND DIES — for pipe threads, 1/2 in. to 1 in.
VISES
- *a*) Machinist's, 4 in.
- *b*) Pipe

WRENCHES
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop—Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1 1/2, and 2 in. wide
ARMORED CABLE
- *a*) 2 wire, No. 14, single strip
- *b*) 3 wire, No. 14, single strip
- *c*) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — 3/4 in., No. 19, and 1 1/2 in., No. 16
BRAKE LINING — 1/4 by 2 in.
BRUSHES — carbon, for motors and generators
BURGLAR CONTACTS
- *a*) Open circuit
- *b*) Closed circuit

BUSHINGS
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- *a*) Bushings, 1/2 in., 3/4 in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, 1/2 in., 3/4 in., and 1 in.
- *e*) Rigid, 1/2 in., 3/4 in., and 1 in.

CONDULET
- *a*) Fillings, 1/2 in., LL, LR, and LB
- *b*) Covers, 1/2 in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- *a*) Plug type, renewable, 125 volt, 15 amp.
- *b*) Cartridge type, renewable, 125 volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

GROUND CLAMPS — 3/8 in. to 1 in., assorted
HICKEY GRIPS — 1/2 in. and 3/4 in.
LAMPS
- *a*) Carbon, 220 volt, 60 watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- *a*) Metal
- *b*) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, 3/8 in., 1/2 in., 3/4 in., and 1 in.
PUSH BUTTONS
- *a*) Return call, 3 point
- *b*) Single

RECEPTACLES
- *a*) Flush, duplex
- *b*) Porcelain cleat, 660 watt, 250 volt
- *c*) Concealed
- *d*) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- *a*) Compression, 275 watt
- *b*) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, roundhead, 4–36 by 1/4 in., 6–32 by 1/2 in., 6–32 by 3/4 in., 8–32 by 3/8 in., 8–32 by 1/2 in., 8–32 by 1 in., 10–32 by 3/8 in., 10–24 by 3/8 in., 10–24 by 3/4 in., 10–32 by 3/4 in., 12–24 by 1 in.
- *c*) Machine, brass, roundhead, 4–36 by 1/4 in., 6–32 by 1/2 in., 6–32 by 3/4 in., 8–32 by 1/2 in.
- *d*) Wood, flathead bright, No. 5 by 3/4 in., No. 8 by 1/2 in., No. 8 by 3/4 in., No. 8 by 1 in., No. 7 by 1 1/2 in., No. 8 by 1 1/2 in., No. 7 by 2 in.
- *e*) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1 1/2 in., No. 10 by 1 1/2 in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- *a*) Brushed, brass pull chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

SOCKET CAPS — 1/4 in. and 3/8 in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2-oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.

(Continued on page 80A)

VALUABLE EDUCATIONAL AIDS

Electrical Laboratory Apparatus and Educational Service

General Electric engineers will gladly recommend apparatus to meet your special conditions if you will give them such details as: type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company, or write direct to the Educational Sales Section, General Electric Company, Schenectady, N. Y.

Usually, the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.

Where standard apparatus is not suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185, which has been recently revised, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Electrical Laboratory and Shop Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62 will be particularly useful. In this booklet will be found, listed in three different groups, equipment to meet a wide range of requirements. For the elementary courses, a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well-balanced laboratory equipment which will permit a wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Illustrated Lecture Service

Descriptive manuscripts, accompanied by suitable slide films, are available for general use, free of charge. The slides are arranged in accordance with their location in the manuscript. A few lectures are available on glass lantern slides only, but the majority are available on 35-mm standard film.

These lectures are particularly valuable to schools and colleges, technical societies, chambers of commerce, and boards of trade. While the lectures in a few instances cover the subject in a purely technical manner, most of them are so prepared as to be interesting to the general public, and in these the subjects are treated in a more popular way.

All text and slide films are furnished without charge. The text and slide films may be retained by the user, but all glass slides must be returned with transportation prepaid.

Photo News Service

For many years, General Electric has furnished some 5000 schools and colleges in this country and abroad with semimonthly news posters which tell briefly, authoritatively, and interestingly the story of the accomplishments of electricity — the most recent developments in the research laboratories of the Company — experiments with man-made lightning — electric ships, spectacular lighting, precision instruments, short-wave radio, X ray. These posters have come to be almost standard equipment for many general-science teachers. They are published on the 1st and 15th of every month from October 1 through June 15. The service is free. Teachers only should apply for it, and should give their school address.

Motion-picture Films

An extensive motion-picture service is maintained by the General Electric Company for the purpose of disseminating throughout the United States reliable information concerning important developments in the electrical field.

The service provides motion-picture films by means of which the details of manufacture and the use of electric products are presented in a highly instructive manner.

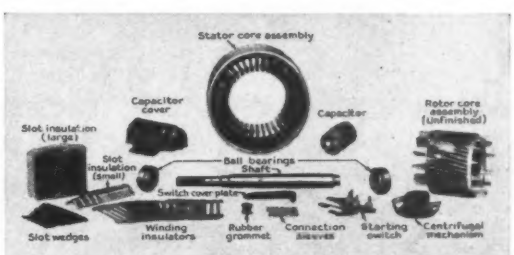
Silent pictures are furnished either in 35-mm, safety or nitrate stock, and 16-mm safety stock.

All sound pictures are available in 16-mm sound on film, safety base. Many are also available in 35-mm size. Films are lent free of charge with transportation charges paid by user.

These films are listed and described in General Electric's motion-picture catalog, GES-402, copies of which may be had upon application to the nearest G-E sales office. Requests for the use of motion-picture films should be addressed as directed in that publication and will receive the attention of a specialist.

Educational Construction Projects

The General Electric Company, in carrying out its educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop since they



A typical motor kit, exclusive of castings

are not merely assembly projects, but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The G-E projects have the following standard ratings and are completely described in the G-E bulletins indicated:

(1) ¼-hp, single-phase, 60-cycle, 110-volt capacitor-motor, GEA-3514.

(2) ½-hp, single-phase, 60-cycle, 115/230-volt capacitor-motor, GEA-3526.

(3) ½-hp, 3-phase, 60-cycle, 220-volt motor, GEA-3542.

(4) 250-watt, 125-volt, compound-wound d-c generator, GEA-2289.

(5) 1½-kva, 220-55/110-volt, 60-cycle air-cooled transformer, GET-569.

GENERAL ELECTRIC

Electrical Training Goes **ALL-OUT** *for Victory!*

ABOVE: The electrical laboratory of the McKeesport Vocational School, McKeesport, Pa., fully equipped with Standard Test and Distribution Panels.

STANDARD *Test* and Distribution Panels Step-Up Instruction Efficiency

.. Industry is calling for more and more trained technicians—and our schools are answering with faster, more efficient instruction. Standard Test and Distribution Panels are helping facilitate thorough electrical training. Standard equipment provides quick, convenient arrangements for securing current of variable voltages and types, distributed to working benches or tables. Ideal for all types of electrical problems, from elementary to advanced work. Let our experienced field engineers explain in detail. Write

"Standard Makes Every Minute Count"

THE STANDARD ELECTRIC TIME COMPANY

79 LOGAN ST., SPRINGFIELD, MASS. BRANCH OFFICES IN PRINCIPAL CITIES

(Continued from previous page)

STARTING BOXES
- *a*) For compound motors, various makes
- *b*) For shunt wound, 1 h.p., 110-volt motors. Overload release
- *c*) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- *d*) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt

SWITCH
- *a*) Battery, 4 point
- *b*) Bases, porcelain, for 10-amp. switches
- *c*) Boxes, 2¾ in. deep
- *d*) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
- *e*) Entrance, safety, 3 pole, 30 amp., 250 volt
- *f*) Flush, push button, S.P., D.P., 3 way, 4 way
- *g*) Surface, S1, S3, and S4
- *h*) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- *j*) Surface, snap, electrolier
- *k*) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required

TACKS — double-pointed No. 10

TAPE
- *a*) Friction, ½-lb. rolls
- *b*) Rubber, ½-lb. rolls

TELEGRAPH SETS — including sounders, keys, and relays

TELEPHONES
- *a*) Complete bridging, independent phones
- *b*) Couch vestibule telephones
- *c*) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

TRANSFORMERS
- *a*) Bell ringing, 6, 8, 14 volt
- *b*) Single phase, 110–220 volt, S.K.V.A.

TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.

TUBING — flexible nonmetallic, ¼ in. and ⅜ in.

WASHERS
- *a*) Iron, ¼ in. and ⅜ in.
- *b*) Brass, ¼ in. and ⅜ in.

WIRE
- *a*) Annunciator No. 18 or No. 20
- *b*) Fixture, No. 18, single yellow, with marker
- *c*) Rubber covered, solid copper, No. 10, black
- *d*) No. 10, white
- *e*) No. 14, black
- *f*) No. 14, white
- *g*) Rubber covered, No. 16, brewery cord
- *h*) No. 18, lamp cord, green and yellow
- *j*) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop—Motor and Testing Equipment

ANNUNCIATORS
- *a*) Automatic needle drop
- *b*) Gravity drop
- *c*) Manual needle drop

ARMATURES — burnt out, for repairing

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- *a*) Air, single pole, overload, 25 amp., 550 volt
- *b*) Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- *a*) For multiple-speed motor
- *b*) For 1 h.p., 110-volt series motors

GENERATORS
- *a*) Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- *b*) Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- *c*) Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- *a*) Ammeter, standard, 60 amp., a.c.
- *b*) Ammeter, standard, 60 amp., d.c.
- *c*) Ammeter, student, 60 amp., a.c.
- *d*) Ammeter, student, 60 amp., d.c.
- *e*) Voltmeter, standard, 0–10 volt, d.c.
- *f*) Voltmeter, standard, 110–220 volt, d.c.–a.c.
- *g*) Voltmeter, standard, 125 volt, a.c.
- *h*) Voltmeter, standard, 125 volt, d.c.
- *j*) Voltmeter, student, 110 volt, d.c.
- *k*) Voltmeter, student, 110 volt, a.c.
- *l*) Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- *m*) Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- *n*) Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- *a*) Auto starter, different makes
- *b*) Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- *c*) Compound, 1 h.p., 110 volt, d.c.
- *d*) Multiple speed, 1 h.p., 3 phase, 220 volt
- *e*) Series, 1 h.p., 110 volt, d.c.
- *f*) Shunt, 1 h.p., 110 volt, d.c.
- *g*) Split phase and repulsive, a.c., 110 volt, single phase, assorted
- *h*) Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- *j*) 3 phase, 1 h.p., a.c., 220 volt, various makes
- *k*) 3 phase, 2 h.p., 220 volt, a.c., various makes
- *l*) Universal, fractional h.p., 110 volt, different makes
- *m*) Universal, variable speed, ½ h.p.

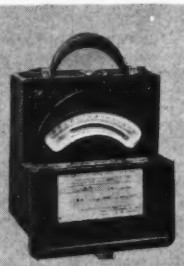
PLATFORM SCALE — 100 lb. capacity

The World's STANDARDS OF ACCURACY

for Instruction, Research, Industry

The widespread use of WESTON instruments in vocational education has become a fixed principle...primarily because these are the measurement standards so widely used throughout industry. Thus the student becomes thoroughly familiar with the instruments he will use throughout his industrial career. They are preferred, too, because they inspire students to be more exacting in their work, and because they represent a truly sound investment...combining ruggedness, dependability and long life.

Following is a condensed listing of the WESTON instruments available . . . also are illustrated a few of the models most widely used in educational work. Complete information on any WESTON instrument is available and will gladly be sent on request. Write to . . . Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark, New Jersey.



Model 45
D. C. Instruments

Sturdy portable test instruments for accurate testing. Magnetically shielded, polished hardwood case. Accuracy ½ of 1%. Hand calibrated mirror scales of long length. Available in Voltmeters, Ammeters, Milliammeters, Volt-Ammeters.

Model 430
Portable, Precision A. C. and D. C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.

Model 785
Industrial Circuit Tester

Provides 27 ranges . . . all the ranges necessary for voltage, current and resistance measurements in signal, control and electronic circuits, or wherever else high sensitivity is a factor.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

RELAYS
Sensitive and Power Uses – Current and Voltage Types

INSTRUMENT TRANSFORMERS
Portable and Switchboard – Potential and Current

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types – Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

PHOTOELECTRIC CELLS
"Photronic" Cells – Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Cell Controls, Illumination Controls, Smoke Alarms, Industrial Controls

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters, Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE – Remote Indicating
BIMETALLIC DIAL TYPE – Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

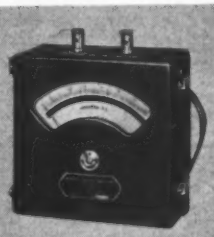
STANDARD CELLS

**Photronic – A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

WESTON *Instruments*

Model 489 and 528
Small A. C. and D. C. Instruments

Small, sturdy, inexpensive . . . for all-around A.C. and D.C. testing where moderate accuracy is sufficient. Available in Voltmeters, Ammeters, Milliammeters. A.C. models available in single, double and triple ranges.



Model 155
A. C. Instruments

Single or multi-range instruments, movable iron type, for general testing where high accuracy and long scale length are desired. Ammeters available with ranges up to 500 amperes, self-contained; Voltmeters up to 750 volts, self-contained. Sturdy, hardwood cases.

Model 623
A. C. Clamp Ammeter

Current readings obtained simply by placing clamping jaws around conductor. Circuits never disturbed. 6 current ranges. High insulation for complete protection.

Model 772
Super-Sensitive Radio Set Tester

Sensitivity of 20,000 ohms per volt. Adequate voltage, current, resistance and output meter readings for servicing receivers, transmitters, P.A. systems, vacuum and cathode ray tube equipment, communications circuits, etc.

SHOP BOOKS

• FOR VOCATIONAL • DEFENSE COURSES
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A new shop book titled "GENERAL PRINTING" covers all phases of printing: composition, proofing, presswork and the like, and has a quantity of related material on machine typesetting, papers, inks, designing and historical background on printing. Hundreds of actual step-by-step photographs of exceptional clarity. Single copy—$1.60. *Cleeton & Pitkin.*

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(Continued from page 78A)

this firm manufactures, and which under present conditions will do invaluable service in helping the defense industries of America key up production for wartime service.

The catalog contains full description of their saws, varying from 6- to 12-in. blades, and groover saws with cutting capacities from 1- to 2-in. widths. Electric drills of many shapes and designs, suitable for ¼-in., 5/16-in., ⅜-in., ½-in., ⅝-in., ¾-in., and ⅞-in. drills are available. Belt sanders are made in 2¼-in., 3-in., and 4½-in. widths. Disk sanders in 7- and 9-in. diameters are available, as are also 6-, 7-, and 10-in. bench grinders.

Their line of floor sanders, floor edgers, and general accessories also are illustrated and described.

MANUAL ON BLOWTORCHES

Apprentices, trade school students, and others will find the new booklet just issued by the Clayton and Lambert Manufacturing Co., of Detroit, pioneer manufacturers of blowtorches and fire pots, not only interesting but quite instructive. The booklet, called "Torch Pointers," is published in handy, pocket size, and is available at no charge from the Clayton and Lambert Manufacturing Co.

Text and illustrations describe the component arts of the blowtorch, the principles on which it operates, and the best methods of filling, starting, and stopping. There are sections on trouble shooting, how to disassemble and reassemble the burner, on hard and soft soldering, brazing, sweating, removing paint, and other typical torch operations. One section is devoted entirely to safety hints.

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The Navy "E" for excellence has been awarded to the South Bend Lathe Works in consideration of outstanding performance in the production of ordnance material for the United States Navy. The Lathe Works has consistently been "ahead of schedule" on lathe shipments for the Navy and its prime and subcontractors.

Mr. J. J. O'Brien, Chairman of the Board, and Mr. R. E. Frushour, President, of the South Bend Lathe Works, with the Navy Ordnance Flag and "E" Pennant awarded to the company

— Photo by South Bend Tribune

Formal presentation of the award of the "E" Pennant and Navy Ordnance Flag, was made at the South Bend Lathe factory at South Bend, Ind., February 3, 1942. To enable all employees to be present without loss of time, the presentation was made at noon, during the regular lunch hour.

Representing the Navy were Rear Admiral Henry V. Butler, Jr., U.S.N., retired, Captain Henry P. Burnett, U.S.N., Lieutenant L. F. Brozo, U.S.N.R., and Ensign John T. Barnett, U.S.N.R. The company was represented by Mr. John J. O'Brien, chairman, board of directors, and Mr. R. E. Frushour, president of the corporation.

ATKINS HELPS DEFENSE STAMP SALES

E. C. Atkins and Co., saw manufacturers of Indianapolis, Ind., have just issued a new bulletin giving list prices and specifications of their hacksaw and metal saw blades. One cover of this bulletin carries a reproduction of the large government poster encouraging the purchase of defense stamps. Since this bulletin reaches many thousands of manufacturers, wholesalers, and dealers throughout the country, it is hoped that it will lend extensive support to the sale of defense stamps.

AN INSTRUCTION BOOKLET

A booklet entitled "Machine Shop Engineering" is offered with the Monroe Educator, a calculator designed for schools for use in shop-practice courses in vocational schools training for defense industries.

Methods of handling mechanically the mathematics of boring holes in jigs, templates, or dies, odd gear ratios and design of long and short addendum gears, as well as square root, are all outlined in this booklet which can be secured by a school at no cost by contacting the nearest office of the Monroe Calculating Machine Co., Inc., or writing to the Educational Department, Monroe Calculating Machine Co., Inc., Orange, N. J.

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These two books recognize the vast growth in the importance and practicality of a knowledge of mechanical drawing in numerous situations in everyday life.

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Book II **is an introductory study of pattern drawing, machine drawing, architectural drawing, and mechanical drawing, providing practice in the application of the principles learned in Book I. The material is planned to cover two to three semesters of work, but may be extended over a longer period.**

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(Continued from page 74A)

president, New York Agricultural Teachers Association, Wolcott, N. Y., spoke on "Development of Service Programs for Out-of-School Young Men on Farms."

This same group held a meeting Saturday morning at which George E. Micheal, president, New Jersey Agricultural Teachers Association, presided.

Darrell F. Long, teacher of agriculture, Woodcrest, Del., in his discussion of "Increased Food and Feed Production," called attention to the great need of sound service programs for out-of-school farm youths. The war will require the production of more food and those remaining on the farm must learn to work with more efficiency.

"Farm Machinery Repair and Maintenance" was discussed with considerable detail by Paul Gilman, teacher of agriculture, Thetford, Vt., Harry Schneiber, teacher of agriculture, Belvidere, N. Y., and Arthur Townsend, county supervisor of agriculture, Bedford County, Pa.

Industrial Education

The Industrial Education meeting on Wednesday afternoon was presided over by F. Theodore Struck, head, department of industrial education, The Pennsylvania State College, State College, Pa.

The leader of the open forum was Homer J. Smith, professor of industrial education, University of Minnesota, Minneapolis, Minn. The theme chosen was "Problems, Procedures, and Trends in Industrial-Teacher Training for National Defense."

The speakers were Lynn A. Emerson, professor of industrial education, Cornell University, Ithaca, N. Y., Jerry R. Hawke, regional agent, trade and industrial education, U. S. Office of Education, Washington, D. C., A. B. Mays, professor of industrial education, University of Illinois, Urbana, Ill., J. G. Spofford, assistant for training teachers of trades and industries, state department of education, Trenton, N. J., M. Norcross Stratton, assistant director, vocational education, state department of education, Boston, Mass., Clyde H. Wilson, head, department of industrial education, Texas A. and M. College, College Station, Tex.

The theme, "Effective Programs of NYA Related Training," was discussed at a Thursday morning meeting at which B. H. Van Oot, state supervisor of trade and industrial education, state board of education, Richmond, Va., presided.

The speakers on this occasion were: Bernard S. Miller, state youth administrator, New Jersey, James R. D. Eddy, state director of industrial education, Austin, Tex., William A. Williams, state supervisor of trade and industrial education, Charleston, W. Va., Leonard J. Maloney, director, state employment service, Connecticut, Marion W. Smith, state supervisor of defense training, Wisconsin, M. D. Mobley, state director of vocational education, Atlanta, Ga., Martha G. Creighton, state supervisor of home economics, Richmond, Va., and Powell M. Cabot, assistant director, state employment service, Massachusetts, and a summary was given by Edward H. Lang, associate education supervisor, state department of education, New York.

At the Trade and Industrial Part-Time meeting on Friday morning, Sidney Owen, state director for vocational education, Lincoln, Neb., acted as chairman.

James R. D. Eddy, state director of industrial education, Austin, Tex., spoke on "Part-Time Diversified Occupations."

The subject, "Relationship of Part-Time Education to National Defense Training," was discussed by H. A. Tiemann, state director of vocational education, Denver, Colo.

R. L. Welch, assistant state director of vocational education, Madison, Wis., spoke on "Part-Time Apprentice Training." He made the startling assertion that "Less than a year ago it was reported that Germany had 12,000,000 skilled mechanics who are as clearly identified as lawyers and physicians are in America. Here it is thought that perhaps we have about 4,000,000 skilled mechanics. Germany has 7,000,000 apprentices. We have about 10,000 indentured apprentices. Germany is about three fourths the size of Texas and has a population of about 60,000,000. With our enormous land area, we have 136,000,000 population exclusive of our territories and possessions."

These figures clearly prove how necessary apprentice training is in this country.

Several sessions were devoted to the training for public service occupations, defense training for the army and navy, and on apprenticeship. The question of planning and equipping industrial-arts and vocational school buildings also received attention.

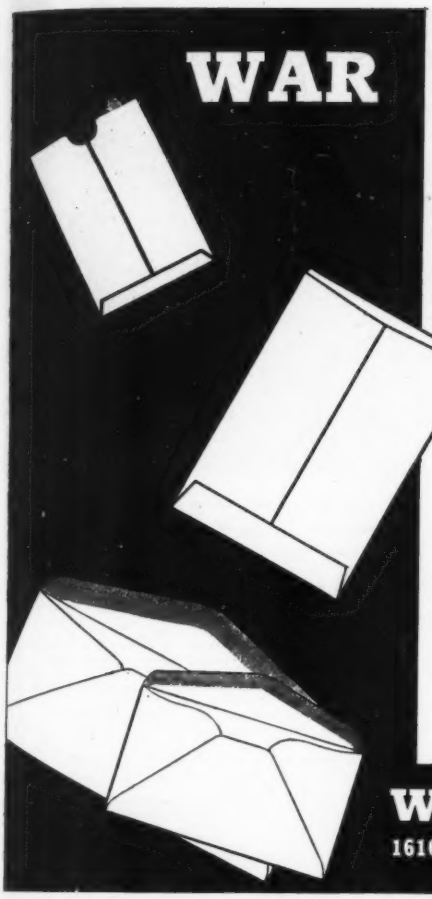
Sectional meetings on airplane mechanics, building construction, cabinetmaking, electricity, machine-shop practice, printing, radio, and welding, were also held.

Vocational guidance and vocational rehabilitation also received attention.

At the House of Delegates meeting, John J. Seidel, state director of vocational education, Baltimore, Md., was elected president; and Arthur B. Mays, professor of industrial education, University of Illinois, Urbana, Ill., was elected for a three-year term as vice-president representing the Industrial-Arts Education Section of the Association. Vice-presidents re-elected for a three-year term are: Dr. Paul H. Nystrom, professor of marketing, Columbia University, New York, N. Y., vice-president for the Business Education Section; and Florence Fallgatter, Iowa State College, Ames, Iowa, vice-president for the Home-Economics Section. For the two years remaining in the term of Mr. Seidel the association elected as vice-president for the Industrial Education Section, John A. McCarthy, assistant commissioner of education in charge of vocational education, Trenton, N. J.

Charles W. Sylvester, director of vocational Education for the board of education in Baltimore, Md., was re-elected treasurer, for the 15th year.

(Continued on page 88A)



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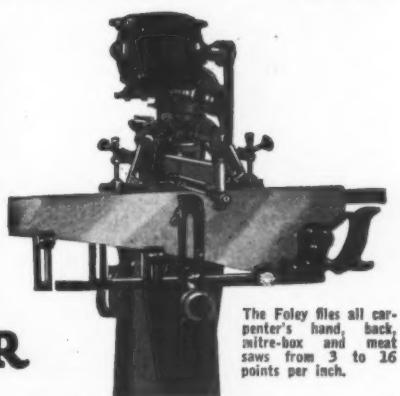

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Authorized by State Board of Higher Education

(Continued from page 86A)

Toledo, Ohio was selected as the 1942 Convention city.

Dr. Robert O. Small, Massachusetts State Director of Vocational Education, in recognition of his services, was presented with a gavel set by retiring President Humphreys on behalf of the National and the Utah Vocational Association. The head of the gavel is solid copper from Utah mines.

Dr. Small was also given the annual citation award by "The Ship," an organization of representatives of exhibitors who participate in the yearly A. V. A. Convention.

The following were elected officers of the National Association of State Directors of Vocational Education for the coming year:

President, C. A. Bell, state director of vocational education, Springfield, Ill.; vice-president, John A. McCarthy, assistant commissioner of education, Trenton, N. J.; secretary-treasurer, W. W. Trent, state director of vocational education, Charleston, W. Va.; executive committee, the three officers and John J. Seidel, Baltimore, Md., R. B. Jeppson, Carson City, Nev., and G. A. Freeman, Nashville, Tenn. Each is director of vocational education for his state.

At the annual meeting of the National Association of Industrial Teacher Trainers, the following officers were elected for the year 1942: president, Dr. Lynn A. Emerson, professor of industrial education, Cornell University, Ithaca, N. Y.; vice-presidents, Professor Clyde Wilson, head, department of industrial teacher training, University of Tennessee, Knoxville, Tenn., Clarence Wetzel, board of education, St. Louis, Mo., and Heber Sotzin, head, department of industrial education, State Teachers College, San Jose, Calif.; secretary-treasurer, Charles Cyrus, University of Texas, Austin, Tex.; trustee, Miss Cleo Murtland, University of Michigan, Ann Arbor, Mich.

♦ The Western Arts Association will hold its annual convention in Kansas City, Mo., April 8, 9, 10, and 11, 1942.

This association, organized in 1893, has expanded to include the territory of 24 states between the Allegheny and the Rocky Mountains. This will be the first meeting of the group to be held west of the Mississippi River.

Outstanding speakers and unusual entertainment features will make this convention one to be long remembered.

Faber Birren, color engineer and member of the faculty of Pratt Institute of Fine and Applied Art, Brooklyn, N. Y.; Allen Eaton of the Russell Sage Foundation, New York; Gladys Miller of the *Madamoiselle* magazine staff; Ralph Pearson, director of Design Workshop, Nyack, N. Y.; and Worth Ryder, muralist, University of California, headline the speakers' list.

Several innovations in the convention program this year will include a visual aids demonstration at each sectional meeting, and an invitation to Art Clubs, Chamber of Commerce members, and other organizations to attend free the general sessions.

Any questions concerning the convention should be addressed to Joseph K. Boltz, secretary-treasurer, at Franklin, Mich.

♦ A constitution for the Southeastern Minnesota Industrial Arts Association was adopted at a dinner meeting of the organization on November 26, 1941, at Hotel Martin, Rochester, Minn.

Committee reports were presented and requests for project suggestions were made. The group will affiliate with the Minnesota Vocational Association and the American Vocational Association, and will hold a spring meeting in Winona, it was announced.

Officers are L. W. Gerecke, Winona, president; R. H. Nordby, Rochester, vice-chairman; and Arthur Paliver, St. Charles, secretary-treasurer. Committee chairmen are Arthur Olson, Lanesboro, membership; Harry Jackson, Winona, program; E. C. Morgenson, Rochester, publicity; and Thomas Richards, Winona, publications.

— Einer Morgenson

♦ The New Jersey Vocational and Arts Association will hold its convention at Asbury Park, N. J., on March 19, 20, and 21. The Berkeley-Cartaret Hotel will be the convention headquarters. The secretary of the association is J. J. Berilla, 549 Corliss Ave., Phillipsburg, N. J.

♦ The West Virginia Industrial-Arts Conference will be held at West Virginia Institute of Technology, Montgomery, W. Va., on Saturday, April 18, 1942. — *Fred W. Eberle*

♦ Officers of the Iowa Industrial Arts Association are already busy making plans for the 1942 Convention which is generally held in the Savery Hotel, Des Moines, Iowa. Officers elected for the present year are: Leland Benz, of Ames, president; James H. Brolliar, of Fairfield, vice-president; and Clarence A. Bootman, of Des Moines, secretary-treasurer. Trustees are H. G. Palmer, of Cedar Falls; Edwin J. Reinel, Council Bluffs; Joe E. Cuffel, of Cherokee; and E. H. Christiansen, Cedar Rapids.

Members of the association were very much pleased with the fine convention program which they enjoyed in November. Dr. T. A. Hippaka, of Iowa State College, Ames, Iowa, addressed the Fellowship Dinner on the subject, "The Industrial-Arts Curriculum for Iowa." Later he distributed a handbook in industrial arts for Iowa which was completed under his direction last year.

Other educators appearing on the program were Superintendent Jordan L. Larson, of Dubuque, Iowa, who spoke on the subject, "Industrial Arts in the Large High School." Superintendent G. E. Holmes of Story City, Iowa, spoke on the subject "Industrial Arts in the Small High School."

The association elected Dr. T. A. Hippaka permanent chairman of the State Industrial Arts Committee.

One of the features of the convention was the adoption of a new revised constitution for the association.

Many members of the association reported fine progress in the upgrading of industrial education

(Continued on page 92A)

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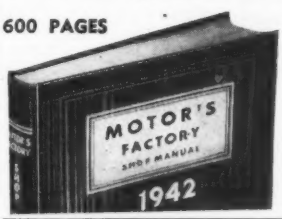

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Gauges, Generators	Journal
Clutches, Brakes	Lubrication and
Universals	Capacity Charts,
Rear Ends, Steering	Etc.
Shock Absorbers	Engine
Wheels, Etc.	Electric System
Tune-Up Chart	Free Wheel,
Torque Wrench	Overdrive
Readings	Fluid Coupling, Etc.
Valve Measurements	Torpedo Bodies
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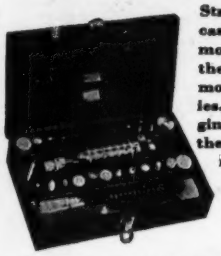
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(Continued from page 88A)

in their various communities. Shops have been remodeled, additional equipment has been purchased, and new courses added.

♦ The program committee of the Michigan Industrial Education Society is proceeding with the thought in mind that every member of the society who will attend the convention which is to be held at the Book-Cadillac Hotel in Detroit on April 9, 10, and 11, will have opportunities to receive instruction and inspiration from national leaders at the time when all industrial education is being called upon for such service to the nation as it never before has experienced.

The convention theme — "Industrial Education — Meeting the Needs of the American Way of Life" — is the challenge this year. The future demands a trained personnel to meet the problems of today and of the future.

The annual banquet and dinner will be held Friday evening, and on Saturday morning demonstration and discussion groups will have their meeting.

♦ The January meeting of the School Crafts Club was held at the Hotel Imperial, Broadway and 32nd St., New York City on Saturday the 24th of January.

A lively discussion on a timely topic, "Industrial Arts Education for National Defense," ably led by Perry L. Schneider, was the high light of the evening.

After four decades of useful and faithful service in the cause of industrial arts, the School Crafts Club takes just pride in announcing its 40th anniversary celebration to be held sometime in May. Our May meetings are always long remembered, and the Committee on Arrangements are now making plans deserving of this occasion; therefore, former members from far and near are requested to write the secretary, Mr. Ralph Carter, 115 Plane St., Newark, N. J.

Our next meeting will be held on February 28th at the Hotel Imperial, dinner at 6:30 p.m., business meeting at 8 p.m.

— *John M. Matheson*

♦ The annual meeting of the Massachusetts Industrial Education Society was held Saturday, January 10, at the Hotel Lenox, Boston, Mass. One hundred fifty members attended, and President Arthur Robinson of Arlington, presided. Short talks were given by John W. Wood, headmaster, Rindge Technical High School, Cambridge, and M. Norcross Stratton, division of vocational education, Commonwealth of Massachusetts. The main address, "The Training for and the Future of Industrial Arts," was delivered by Dr. Charles M. Herlihy, president of Fitchburg State Teachers College.

He pointed out that industrial-arts teacher training in the present crisis has been officially recognized by the army and navy, state and local draft boards, federal civil service, and the aviation services.

He also suggested that every senior high school industrial-arts shop should be offering short-term courses for junior and senior boys and girls in the fields of mechanical drawing and blueprint reading, and the fundamentals of machine lathe and drill-press work, and that continued efforts be made by all workers in industrial arts to define a defensible philosophy of this work in the scheme of general education.

He emphasized the Fitchburg philosophy of teacher training in industrial arts which demands that every shop teacher be a college trained member of the teaching profession, who is well equipped with basal skills in unit shop and general shop programs.

Invited guests were M. Norcoss Stratton, division of vocational education, Massachusetts; Fordyce T. Reynolds, president of Massachusetts School Superintendents' Association; Phillip J. Spang, president of Massachusetts Vocational Association; Joseph F. Keating, superintendent of schools, Arlington, Mass.; Mayo M. Magoon, president of High School Principals' Association; A. Henry Ottoson, president of Junior High School Principals' Association.

The next meeting will be a conference on industrial arts and will be held at the Fitchburg State Teachers College in March.

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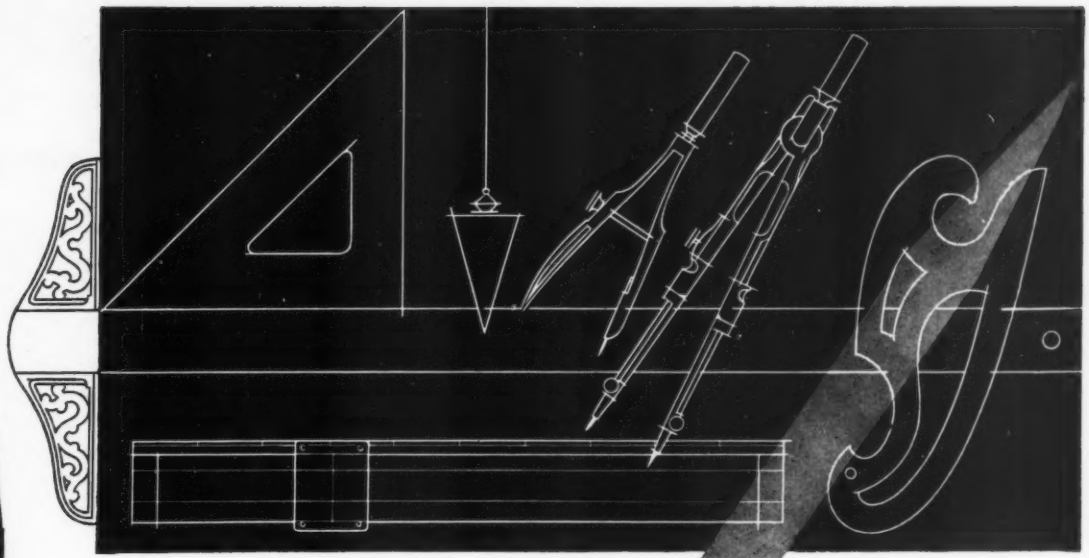

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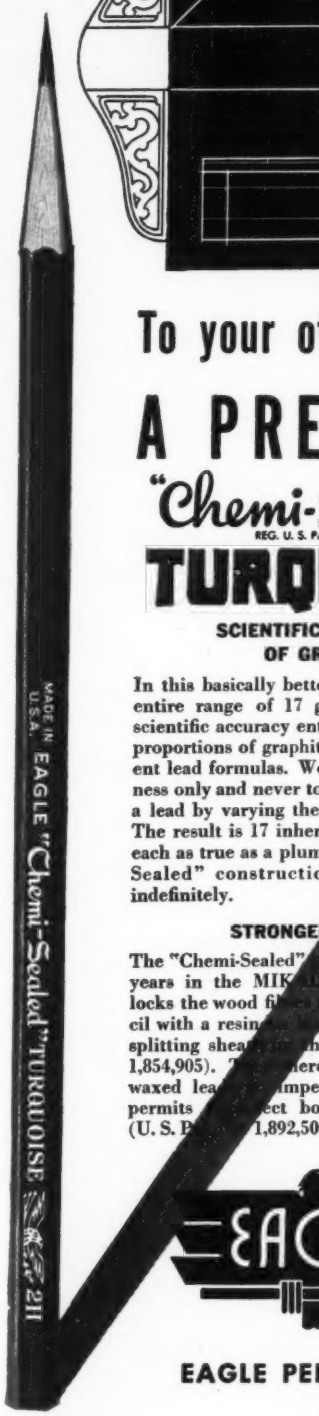

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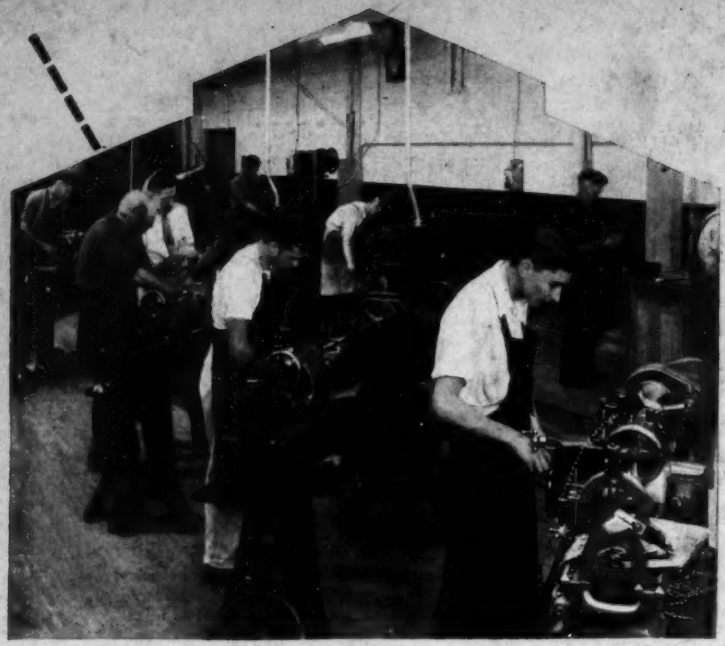

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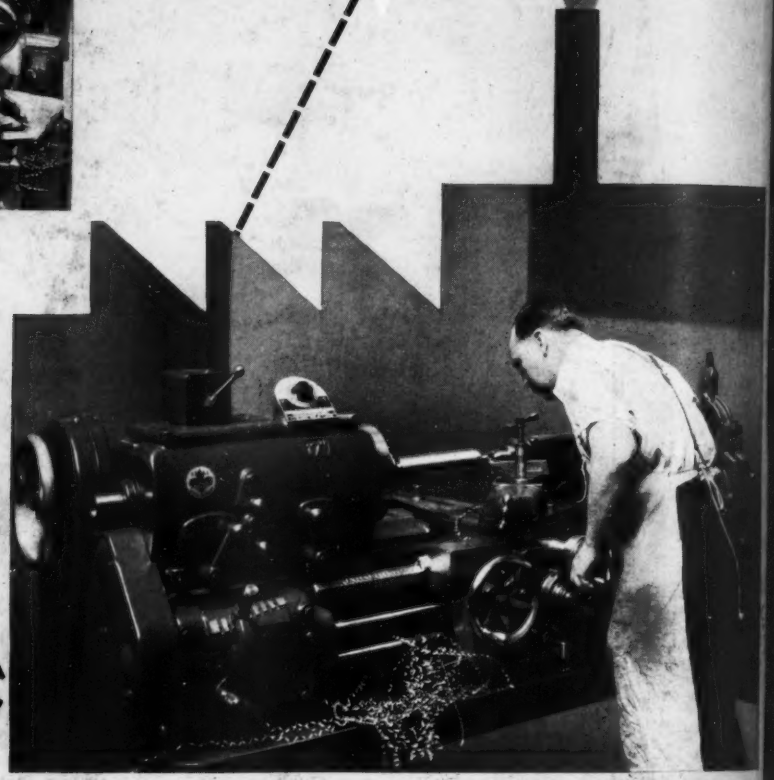

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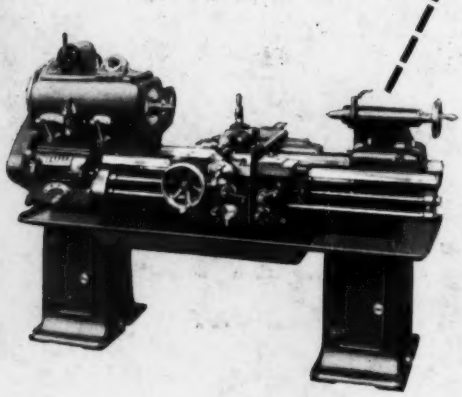

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